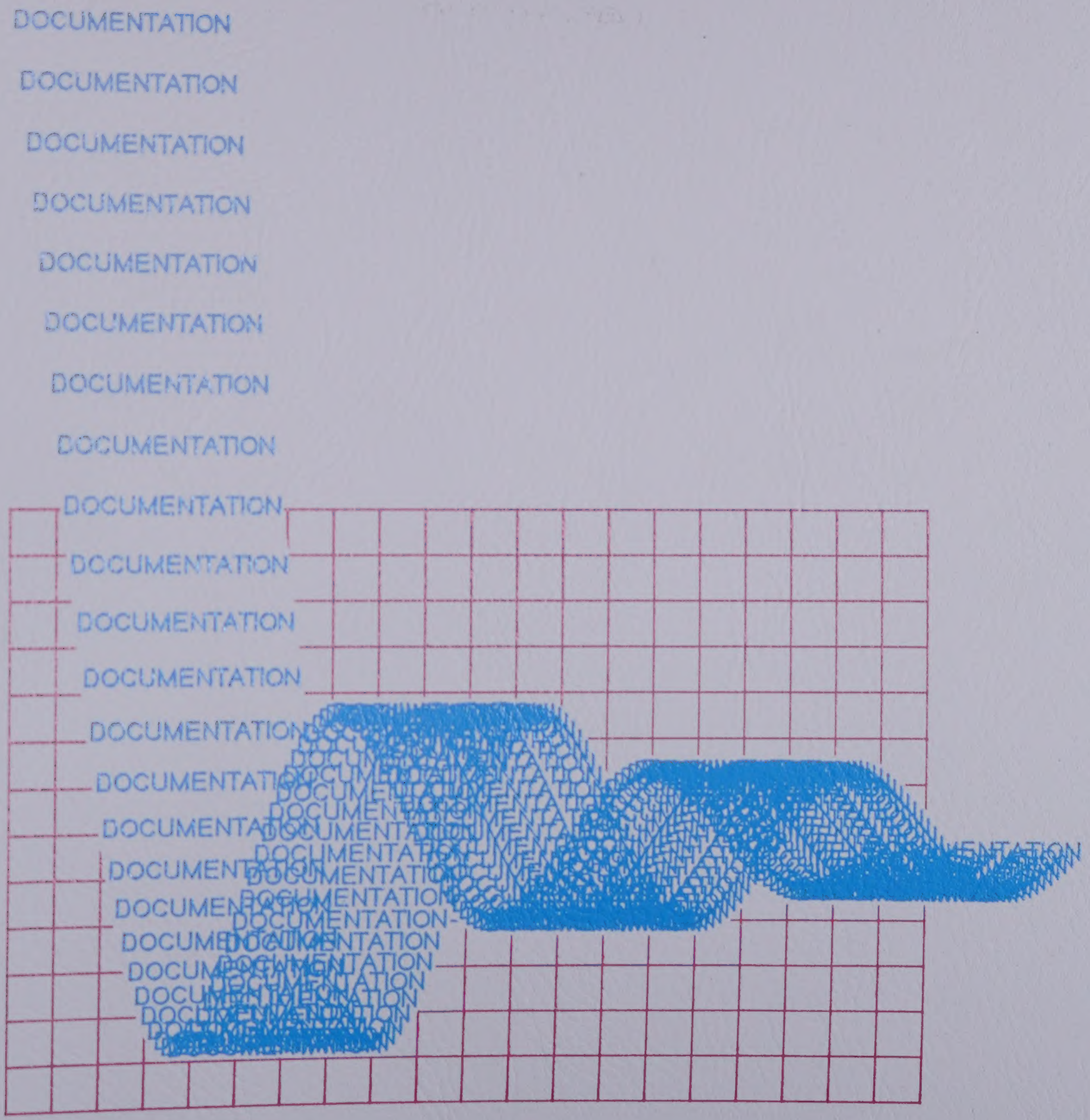
ROHDE & SCHWARZ


DOCUMENTATION

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

Qualitätszertifikat

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde & Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde & Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

Certificate of quality

Dear Customer,

You have decided to buy a Rohde & Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde & Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

Certificat de qualité

Cher client,

Vous avez choisi d'acheter un produit Rohde & Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde & Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

ROHDE&SCHWARZ

Support Center

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Fax: **+49 89 41 29 137 77**

E-mail: **CustomerSupport@rohde-schwarz.com**

Für technische Fragen zu diesem Rohde & Schwarz-Gerät steht Ihnen die Hotline der Rohde & Schwarz Vertriebs-GmbH, Support Center, zur Verfügung.

Unser Team bespricht mit Ihnen Ihre Fragen und sucht Lösungen für Ihre Probleme.

Die Hotline ist Montag bis Freitag von 8.00 bis 17.00 Uhr MEZ besetzt.

Bei Anfragen außerhalb der Geschäftszeiten hinterlassen Sie bitte eine Nachricht oder senden Sie eine Notiz per Fax oder E-Mail. Wir setzen uns dann baldmöglichst mit Ihnen in Verbindung.

Um Ihr Gerät stets auf dem neuesten Stand zu halten, abonnieren Sie bitte Ihren persönlichen Newsletter unter

http://www.rohde-schwarz.com/www/response.nsf/newsletterpreselection.

Sie erhalten dann regelmäßig Informationen über Rohde & Schwarz-Produkte Ihrer Wahl, über Firmware-Erweiterungen, neue Teiber und Applikationsschriften.

Should you have any technical questions concerning this Rohde & Schwarz product, please contact the hotline of Rohde & Schwarz Vertriebs-GmbH, Support Center.

Our hotline team will answer your questions and find solutions to your problems.

You can reach the hotline Monday through Friday from 8:00 until 17:00 CET.

If you need assistance outside office hours, please leave a message or send us a fax or e-mail. We will contact you as soon as possible.

To keep your instrument always up to date, please subscribe to your personal newsletter at

http://www.rohde-schwarz.com/www/response.nsf/newsletterpreselection.

As a subscriber, you will receive information about your selection of Rohde & Schwarz products, about firmware extensions, new drivers and application notes on a regular basis.

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Contents of Manuals for Universal Radio Communication Tester R&S CMU

The user documentation for R&S CMU200 is divided into the operating manual for the basic instrument and separate manual for the individual software and hardware options. The complete documentation is available on CD-ROM, stock no. PD 0757.7746.2x. The latest revisions of all manuals are also posted on the CMU Customer Web on GLORIS.

Operating Manual R&S CMU-K65, CMU-K66, CMU-K67/-K68/-K69 (Software Options: WCDMA UE TX Test (3GPP/FDD) WCDMA (3GPP/FDD, DL) Generator) WCDMA UE Band III/I/II Signalling

The present operating manual describes the application of the WCDMA UE function groups listed above. It gives comprehensive information about the installation of the software, about manual as well as remote control of the instrument. Typical measurement tasks are explained in detail using the functions of the graphical user interface and a selection of program examples.

The manual is organized as follows:

Chapter 1	Describes the steps necessary for installing the software and putting the instrument into operation.
Chapter 2	Gives an introduction to the application of the CMU for WCDMA TX measurements and presents typical measurement examples.
Chapter 3	Gives an overview of the user interface and describes the concepts of measurement control and instrument configuration.
Chapter 4	Represents the reference chapter providing detailed information on all functions of the user interface and their application.
Chapter 5	Describes the basics of remote control of the instrument for WCDMA TX measurements.
Chapter 6	Lists all remote control commands for WCDMA TX measurements. At the end of the chapter the commands are grouped together according to their function (measurement groups or configurations) and sorted in alphabetical order.
Chapter 9	Contains a list of error message that may be generated during the measurements.
Chapter 10	Contains an index for the operating manual.

Operating Manual CMU200/CMU300

In the operating manual for CMU basic unit you will find everything that is needed to make yourself familiar with your Universal Radio Communication Tester CMU200. This includes information about the technical specifications of the CMU, the controls and connectors on the front and rear panel, necessary steps for putting the instrument into operation, the basic operating concept, manual and remote control. Typical measurement tasks are explained in detail using the functions of the user interface and program examples.

General concepts of CMU control are described in the operating manual CMU200 and not repeated in the manuals for the individual software options.

In addition, the operating manual lists the most important warnings and error messages which may be output by the instrument.

Service Manual Instrument

The service manual informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of the CMU by exchanging modules.

Service Manual Modules

The service manual modules is not delivered with the instrument but may be obtained from your R&S service department with the order number 1100.4903.91.

Service manual modules contains information about the individual modules of the CMU. This comprises the test and adjustment of the modules, fault detection within the modules and the interface description.

Further Operating Manuals for Network Tests

The operating manuals listed in the following table describe the test of radio communication equipment supporting different standards by means of the CMU and the appropriate software and hardware options. The network test operating manuals are organized like the present WCDMA operating manual.

		For Options		
Manual	**Order Number**	**Type**	**Description**	**Stock No.**
Operating Manual CMU-K20/-K21/-K22/-K23/-K24	1115.6088.12	CMU-K20 CMU-K21 CMU-K22 CMU-K23 CMU-K24 CMU-K42 CMU-K43 CMU-K45	GSM400-MS for CMU-B21 GSM900-MS for CMU-B21 GSM1800-MS for CMU-B21 GSM1900-MS for CMU-B21 GSM850-MS for CMU-B21 GPRS software extension for GSM EGPRS software extension for GSM AMR GSM for CMU200	1115.5900.02 1115.6007.02 1115.6107.02 1115.6207.02 1115.6307.02 1115.4691.02 1115.6907.02 1150.3100.02
Operating Manual CMU-K27/-K28	1115.6688.12	CMU-K27 CMU-K28	TDMA800-MS for CMU-B21 TDMA1900-MS for CMU-B21	1115.6607.02 1115.6707.02
Operating Manual CMU-K29	1115.6888.12	CMU-K29	AMPS-MS for CMU-B21	1115.6807.02
Operating Manual CMU-K30/-K31/-K32/-K33/-K34	1115.4185.12	CMU-K30 CMU-K31 CMU-K32 CMU-K33 CMU-K34 CMU-K39 CMU-K41	GSM400-BS for CMU-B21 GSM900-BS for CMU-B21 GSM1800-BS for CMU-B21 GSM1900-BS for CMU-B21 GSM850-BS for CMU-B21 MOC/MTC EDGE for CMU-K30/31/32/33	1115.4004.02 1115.4104.02 1115.4204.02 1115.4304.02 1115.4404.02 1115.4791.02 1115.4604.02
Operating Manual CMU-K53	1115.5081.12	CMU-K53	Bluetooth for CMU	1115.5000.02
Operating Manual CMU-K75/-K76	1150.3398.12	CMU-K75 CMU-K76	WCDMA Node B TX Tests WCDMA Generator (3GPP/FDD, Release 99, Uplink)	1150.3200.02 1150.3300.02
Operating Manual CMU-K81/-K82	1115.5581.12	CMU-K81 CMU-K82	CDMA800-MS (IS95) for CMU-B81 CDMA1900-MS (IS95) for CMU-B81	1115.5500.02 1115.5600.02
Operating Manual CMU-K83/-K84/-K85/-K87	1150.0382.12	CMU-K83 CMU-K84 CMU-K85 CMU-K86	CDMA2000-MS (450 MHz band) CDMA2000-MS (cellular band) CDMA2000-MS (PCS band) CDMA2000-MS (IMT-2000 band)	1150.3500.02 1150.3600.02 1150.3700.02 1150.3800.02
Operating Manual CMU-K88	1150.3900.02	CMU-K88	1xEV-DO for CMU-B88	1150.3998.12

The GSM base station tests described in operating manual CMU-K30/-K31/-K32/-K33/-K34 and the WCDMA Node B tests described in operating manual CMU-K75/-K76 require a CMU300 (Universal Radio Communication Tester for BTS). Bluetooth tests can be performed with model CMU200, var. 02 or 53. All other radio communication equipment is tested with model CMU200, var.02.

What's new in this Revision...

This operating manual describes versions V3.50 of the WCDMA UE software options. The new CMU-K65/.../-K69 firmware version provides numerous extensions and improvements. The new features described in this manual are listed below.

New Features	**Description**	**Refer to...**
Inter-cell handover	Handover from a UTRA/FDD frequency band to all GSM destination networks. Superposition of an UTRAN and a GSM cell is supported with option CMU-B95, *Additional RF generator.*	Chapter 4, → Connection Control (Signalling) – Handover
Inter-frequency handover	Change of the RF channel of the UE and BS signal in *Connected* state.	Chapter 4, → Connection Control (Signalling) – UE Signal, BS Signal
DL levels	Common level setting of all DL physical channels with a single remote control command: `SOURce:RFGenerator:PHYSical:LEVel` (Non Sig.) `CONFigure:BSSignal:PHYSical:LEVel` (Signalling)	Chapter 6
RMC data rates	Reference Measurement Channels (RMCs) at higher data rates (384 kbps) and more asymmetric DL/UL RMC combinations for BLER tests	Chapter 4, → Connection Control (Signalling) – BS Signal
Speech codec settings	Extended routing options for voice signals fed to the speech codec *(Voice Source, Speech Encoder, Speech Decoder)*	Chapter 4, → Connection Control (Signalling) – BS Signal, AF/RF Connectors
Audio	Full integration of Audio measurements (option CMU-B41, *Audio Generator and Analyzer)*.	Chapter 4, → Audio Measurements
Spectrum	Refined spectrum emission mask with additional limit line for band II.	Chapter 4, → Spectrum Measurements
TPC settings	Full TPC pattern configuration by means of softkey/hotkey combinations.	Chapter 4, → Power Measurements
MNC	Selectable 2-digit or 3-digit Mobile Network Code (MNC).	Chapter 4, → Connection Control (Signalling) – Network
Keep RRC connection	Possibility to maintain a RRC connection established during registration until the connection is set up	Chapter 4, → Connection Control (Signalling) – Network
DL resources in use	Reduction of the effective DL data rate in order to prevent a buffer overflow	Chapter 4, → Connection Control (Signalling) – Network
Trigger	Selectable *IF Power* trigger threshold and slope	Chapter 4, → Connection Control (Non Signalling) – Trigger

Frequently Used Abbreviations

3GPP	*3rd Generation Partnership Project*
Abs.	*Absolute*
ACLR	*Adjacent Channel Leakage power Ratio*
ACP	*Adjacent Channel Power*
AICH	*Acquisition Indicator Channel*
AM	*Acknowledged Mode*
AMR	*Adaptive Multi Rate*
Avg.	*Average*
BCH	*Broadcast Control Channel*
BER	*Bit Error Rate*
BLER	*Block Error Rate*
CCPCH	*Common Control Physical Channel*
CCTrCH	*Coded Composite Transport Channel*
CDE	*Code Domain Error*
CDMA	*Code Division Multiple Access*
CDP	*Code Domain Power*
CD-ρ	*Code Domain* ρ*-factor*
Chan.	*Channel*
Channel.	*Channelization*
CPICH	*Common Pilot Channel*
CRC	*Cyclic Redundancy Check*
CTFC	*Calculated Transport Format Combination*
Curr.	*Current*
DBLER	*Data Block Error Rate*
DCCH	*Dedicated Control Channel*
Disp.	*Display*
DL	*Downlink*
DPCCH	*Dedicated Physical Control Channel*
DPCH	*Dedicated Physical Channel*
DPDCH	*Dedicated Physical Data Channel*
DTCH	*Dedicated Traffic Channel*
Err.	*Error*
EVM	*Error Vector Magnitude*
Ext./Extern.	*External*
FBI	*Feedback information*
FDD	*Frequency Division Duplex*
FFT	*Fast Fourier Transform*
Freq.	*Frequency*
GPIB	*General Purpose Interface Bus = IEEE488 Bus*
HPSK	*Hybrid Phase Shift Keying*
I	*In-phase*
IF	*Intermediate Frequency*
IMEI	*International Mobile station Equipment Identity*
Int.	*Internal*
IPDL	*Idle Periods in the DownLink*
LAC	*Location Area Code*
Lev.	*Level*
Magn.	*Magnitude*
MAC	*Medium Access Control*
Max.	*Maximum*
MCC	*Mobile Country Code*
ME	*Magnitude Error*
Meas.	*Measurement*
Min.	*Minimum*
MNC	*Mobile Network Code*
OBW	*Occupied Bandwidth*
OCNS	*Orthogonal Channel Noise Simulator*
OTDOA	*Observed Time Difference Of Arrival*
OVSC	*Orthogonal Variable Spreading Code*
P-CCPCH	*Primary Common Control Physical Channel*
PCDE	*Peak Code Domain Error*
PCPCH	*Physical Common Packet Channel*
P-CPICH	*Primary Common Pilot Channel*
PDCP	*Packet Data Convergence Protocol*
PDSCH	*Physical Downlink Shared Channel*
PE	*Phase Error*
PEP	*Peak Envelope Power*
PICH	*Page Indicator Channel*
Pk.	*Peak*

P-SCH	*Primary Synchronization Channel*
W	*Quadrature-phase*
QPSK	*Quadrature Phase Shift Keying*
RAB	*Radio Access Bearer*
RAT	*Radio Access Technology*
RBW	*Resolution Bandwidth*
Ref.	*Reference (marker)*
Rel.	*Relative*
RF	*Radio Frequency*
RLC	*Radio Link Control*
RRC	*Root-raised cosine (filter)*
RSCP	*Received Signal Code Power*
RX	*Receiver*
SCCPCH	*Secondary Common Control Physical Channel*
S-CCPCH	*Secondary Common Control Physical Channel*
SCH	*Synchronization Channel*
Scr.	*Scrambling*
SDU	*Service Data Unit*
SEM	*Spectrum Emission Mask*
SRB	*Signalling Radio Bearer*
S-SCH	*Secondary Synchronization Channel*
SW	*Software*
Sym.	*Symbol*
Sync./Synch.	*Synchronization*
TF	*Transport Format*
TFC	*Transport Format Combination*
TFCI	*Transport Format Combination Indicator*
TFI	*Transport Format Indicator*
TM	*Transparent Mode*
TPC	*Transmit Power Control*
TrCH	*Transport Channel*
Trg.	*Trigger*
TTI	*Transmission Time Interval*
UARFCN	*UTRA Absolute Radio Frequency Channel Number*
UE	*User equipment*
UICC	*Universal Integrated Circuit Card*
UL	*Uplink*
USIM	*UMTS Subscriber Identity Module*
UTRA(N)	*Universal Terrestrial Radio Access (Network)*
Vect.	*Vector*
WCDMA	*Wideband CDMA*

Glossary of Terms

The following list contains definitions of terms that are often used throughout this manual. For a comprehensive overview of WCDMA definitions and abbreviations please refer also to 3GPP TS 21.905 "Vocabulary for 3GPP Specifications" (Release 1999).

Adjacent channel power (ACP)	Power emitted in the first and second adjacent channels, i.e. at ±5 MHz and ±10 MHz from the carrier frequency.
Adjacent channel leakage power ratio (ACLR)	Ratio of the power measured in an adjacent channel (Adjacent Channel Power, ACP) to the transmitted carrier power, expressed in dB. This definition differs from the 3GPP specification by a minus sign but is in line with other systems like GSM and TDMA.
Carrier frequency error	Deviation of the UE modulated carrier frequency from the frequency received from the base station (node B). In the CMU: deviation of the UE modulated carrier frequency from the nominal carrier frequency.
Carrier spacing	Frequency offset between two adjacent carriers (5 MHz).
Channel raster	Frequency offset between the allowed positions of WCDMA carriers (200 kHz).
Channelization code	Orthogonal Variable Spreading Factor (OVSF) codes that preserve the orthogonality between a user's different physical channels. The channelization codes used in the uplink WCDMA signal are OVSF codes with a length (spreading factor) between 4 and 256. In the downlink, a spreading factor of 512 may be used in addition.
Chip rate	Product of the symbol rate and the spreading factor. For the 3GPP WCDMA system a fixed chip rate of 3.84 Mcps is specified.
Code domain	The entire set of channelization codes involved in a WCDMA signal configuration. Measuring a parameter in code domain means to determine its values as a function of the individual channelization codes. For standard uplink WCDMA DPCH signals the assignment between the physical channel contributions and the channelization codes in the I and Q branch is fixed. Therefore, any code domain measurement result can be represented as a function of the physical channel contributions as well.
Code domain error	Ratio of the RMS-averaged power of the error vector projected onto the code domain to the RMS-averaged power of the composite reference signal, expressed in dB.
Code domain power	Power in the individual code channels normalized to the power of the composite signal, expressed in dB.
Code domain ρ factor	Correlated power of an individual channel (ρ factor) divided by the total power of the composite WCDMA signal.
Crest factor	Peak to average ratio: ratio of the peak transmit power in a slot (peak envelope power) to the average transmit power in a slot.
Downlink WCDMA signal	Signal transmitted by a WCDMA base station (node B) to be received by the UE. With option CMU-K66, ***WCDMA (3GPP/FDD, DL) Generator,*** the CMU provides a downlink WCDMA signal consisting of a P-CPICH, P-CCPCH, P-SCH, S-SCH, and DPCH. The individual channels are spread, multiplexed and scrambled according to the rules defined in the standard.
Emission mask	Tolerance template for the spectral emissions in a range between 2.5 MHz and 12.5 MHz away from the UE center carrier frequency. The spectrum emission mask is divided into several areas the power in these areas must be measured with Gaussian filters of different bandwidth.
Error vector	Difference vector connecting the measured and the ideal modulated signal vector.

Error vector magnitude	RMS value of the error vector divided by the RMS value of the reference signal (ideal modulated signal vector), expressed in percent. The error vector magnitude (EVM) is the critical quantity to assess the modulation accuracy of the UE transmitter.
Inner Loop TPC	Transmit Power Control mode where the UE transmitter adjusts its output power in accordance with a series of TPC command received in the downlink.
I/Q imbalance	Difference between the estimated I and Q amplitudes of the measured signal, normalized and expressed in dB units.
I/Q origin offset	Ratio of the I/Q offset vector (i.e. the estimated DC offset of the measured signal) to the average offset-corrected signal vector.
Magnitude error	Difference in magnitude between the measured and the ideal modulated signal vector, normalized to the magnitude of the ideal vector.
Maximum power	Operating mode where the UE is set to its maximum power control level.
Minimum power	Operating mode where the UE is set to its minimum power control level.
Modulation accuracy	Ability of the UE transmitter to generate an ideal QPSK-modulated signal.
Occupied bandwidth	Width of a frequency range around the assigned channel frequency containing 99% of the total integrated power of the transmitted spectrum.
OFF power	Operating mode where the UE is set to is set to the transmit OFF power state where it does not transmit except during uplink compressed mode.
Peak code domain error	Maximum Code Domain Error for all codes in a considered code domain at a specific spreading factor. The Code Domain Error for every code corresponds to the projection of the EVM onto that code. The PCDE is expressed in dB.
Peak envelope power	Maximum power of the RF envelope.
Phase error	Difference in phase between the measured and the ideal modulated signal vector.
Power class	Determines the maximum output power of a WCDMA UE and its tolerances. The four power classes 1 to 4 specified correspond to maximum output powers of +33 dBm, +27 dBm, +24 dBm and +21 dBm.
Power step	Relative power difference between the average power of the target timeslot and the average power of the original timeslot in inner loop power control. The powers are averaged not including the transient duration.
RF channel number	Integer number assigned to an RF channel centered on an integer multiple of the 200 MHz channel raster. The assignment between channel numbers *N* and carrier frequencies *F* is $N = 5 \cdot (F / MHz), \quad 0.0\ MHz \le F \le 3276.6\ MHz$. The WCDMA UE is designed to operate in the uplink band between 1920 MHz and 1980 MHz, corresponding to channel numbers 9600 to 9900. The downlink band ranges from 2110 MHz to 2170 MHz, corresponding to channel numbers 10550 to 10850.
Spectrum emissions	Unwanted emissions immediately outside the nominal channel resulting from the modulation process and non-linearity in the transmitter but excluding spurious emissions. An uplink WCDMA signal must conform to a specified spectrum *emission mask*.
Spreading factor	Length or maximum number of the channelization codes used to spread the WCDMA signal. The spreading factor is the ratio of the WCDMA chip rate of 3.84 Mcps and the symbol rate.
Symbol rate	WCDMA chip rate divided by the spreading factor. The WCDMA standard allows variable symbol rates of 7.5 ksps (downlink only), 15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps and 960 ksps.

Transmit Power Control	The process of adjusting the output power of the UE transmitter in order to optimize the transmission quality of the connection and the network capacity.
Uplink WCDMA signal	Signal transmitted by a WCDMA UE to be received by the base station (node B). An uplink DPCH signal consists of one DPCCH plus up to 6 DPDCHs that are spread, multiplexed and scrambled according to fixed rules.
Waveform quality	Normalized correlated power between the actual and the ideal waveform, sampled at the constellation points. The waveform quality (ρ factor) is a measure of the modulation accuracy. For an ideal transmitter (ideal correlation), it is equal to 1, otherwise it is a positive number smaller than 1.

References

3GPP TS 21.905 "Vocabulary for 3GPP Specifications" (Release 1999)
3GPP TS 25.101 "UE Radio transmission and reception (FDD)" (Release 1999)
3GPP TS 25.211 "Physical channels and mapping of transport channels onto physical channels" (Release 1999)
3GPP TS 25.212 "Multiplexing and channel coding (FDD)" (Release 1999)
3GPP TS 25.213 "Spreading and modulation (FDD)" (Release 1999)
3GPP TS 25.214 "Physical layer procedures (FDD)" (Release 1999)
3GPP TS 25.215, "Physical layer - Measurements (FDD)" (Release 1999)
3GPP TS 25.306 "UE Radio Access capabilities definition" (Release 1999)
3GPP TS 25.323 "Packet Data Convergence Protocol (PDCP) specification" (Release 1999)
3GPP TS 25.331 "RRC Protocol Specification" (Release 1999)
3GPP TS 34.108 "Common Test Environments for User Equipment (UE) Conformance Testing" (Release 1999)
3GPP TS 34.109 "Terminal logical test interface; Special conformance testing functions" (Release 1999)
3GPP TS 34.121 "Terminal Conformance Specification Radio transmission and reception (FDD)" (Release 1999)

Application Note 1GP39_0E: "W-CDMA Signal Generator Solutions by Rohde & Schwarz"
Application Note 1EF44_0E: "Measurements on 3GPP Base Station Transmitter Signals"

For more application notes and information related to our instruments please refer to http://www.rohde-schwarz.com/www/dev_center.nsf

Supplement to the Operating Manual
for Universal Radio Communication Tester
CMU200

Corrections to the data sheet, no. 757.4318.25 (10/2001)

RF generator

Usable frequency range (not specified)	10 MHz to 2700 MHz

Signal Quality	**page 28**
Error vector magnitude (EVM)[1]	<8%, rms

RF analyzer (TX measurements)

Usable frequency range (not specified)	15 MHz to 2700 MHz

The following addendum applies to the *Power/Slot Table* measurement application which is available for firmware versions V3.07 and higher:

Level Uncertainty **page 29**

For the *Power/Slot Table* measurement an additional uncertainty of typ. 0.2 dB is given.

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[1] Global EVM for DL reference measurement channels (according to 3GPP TS 34.121 C3.1 to C3.4) with DPCH/CPICH = 0 dB.

Contents

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Enabling Software Options 1.6

1 Installation

This chapter describes the installation and update of the WCDMA UE software options R&S CMU-K65 to R&S CMU-K69 for the Universal Radio Communication Tester R&S CMU200.

The WCDMA UE software options provide the following functionality:

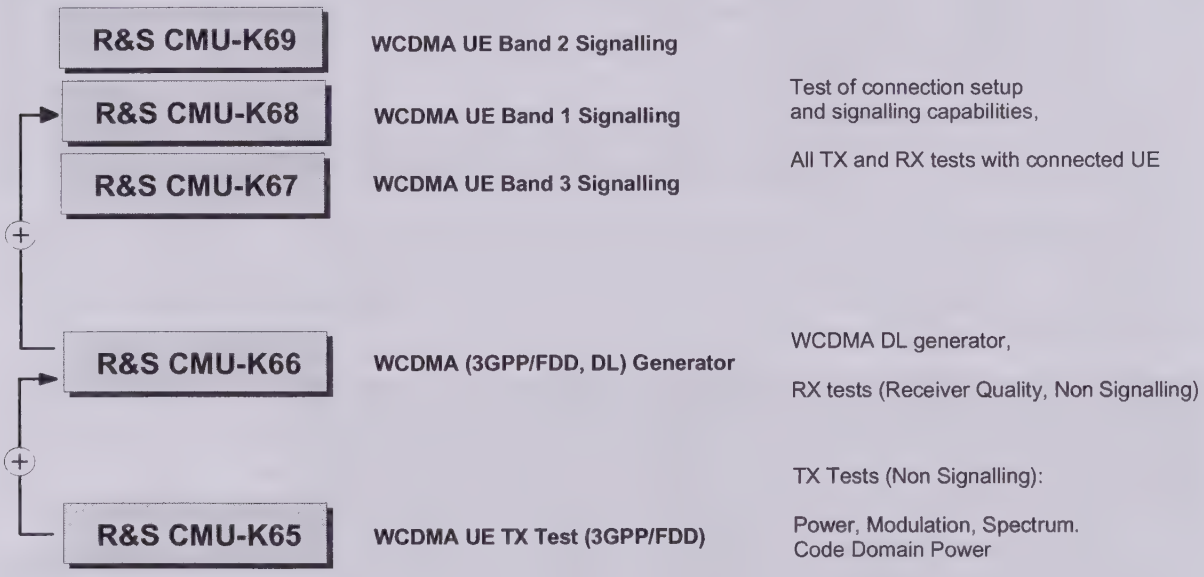

R&S CMU-K69
WCDMA UE Band 2 Signalling
R&S CMU-K68
WCDMA UE Band 1 Signalling
R&S CMU-K67
WCDMA UE Band 3 Signalling
Test of connection setup and signalling capabilities,
All TX and RX tests with connected UE
+
R&S CMU-K66
WCDMA (3GPP/FDD, DL) Generator
WCDMA DL generator,
RX tests (Receiver Quality, Non Signalling)
+
R&S CMU-K65
WCDMA UE TX Test (3GPP/FDD)
TX Tests (Non Signalling):
Power, Modulation, Spectrum.
Code Domain Power

Fig. 1-1 WCDMA UE options

Installation Instructions

Before proceeding to perform any of the steps described in this manual, please make sure that the instrument is properly connected and put into operation according to the instructions given in chapter 1 of the CMU200 manual. The hardware and software options available are shown in the *Startup* menu. The status of the software options required for GSM mobile tests is indicated in the lines *CMU-K65 WCDMA UE TX Tests (3GPP/FDD, CMU-K66 WCDMA UE DL Generator (3GPP/FDD), CMU-K67 WCDMA UE Band 2 Signalling,), CMU-K68 WCDMA UE Band 1 Signalling,), CMU-K69 WCDMA UE Band 3 Signalling:*

- If a version number is indicated, the CMU is ready to perform GSM mobile tests. In this case you may skip this chapter, except if you wish to update the current software version or activate another version.
- If *disabled* is indicated, the software option must be enabled using a key code; see section *Creating a new Software Configuration* on page 1.4.
- If *not installed* is indicated, the software must be installed via the PCMCIA interface or the floppy disk drive, see below.

Option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, and options CMU-K67/.../-K69, *WCDMA UE Band III/I/II Signalling,* are included in the WCDMA UE software package. There is no need to install these supplementary options separately; however, they must be enabled by means of a separate key code supplied with the option (see section *Enabling Software Options* on p. 1.6).

Software Installation or Update

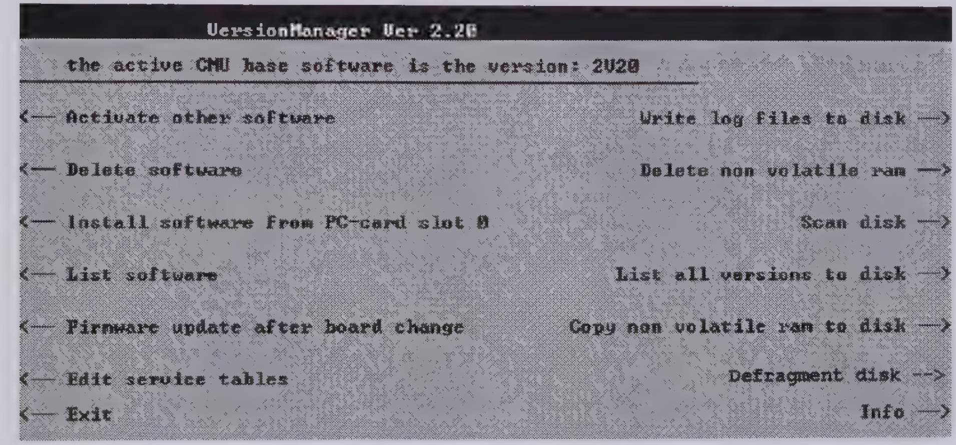
The CMU is always delivered with the latest software version available. New CMU software versions are available for download on the R&S Lotus Notes Service board. To be loaded via the PCMCIA interface, the software must be copied to one or several flash disks/memory cards or PCMCIA hard disks. An appropriate memory card CMU-Z1, order no. 1100.7490.02, can be obtained from Rohde & Schwarz.

Note: *If your CMU is equipped with a floppy disk drive (option CMU-U61), a set of installation floppy disks must be generated instead of a flash disk. All other steps do not depend on the storage medium.*

To install the *WCDMA* options proceed as follows:

- ➢ Switch off the CMU.
- ➢ Insert the flash disk into one of the two slots of the PCMCIA interface.
- ➢ Switch on the CMU.

The installation is started automatically while the CMU performs its start-up procedure. To this end the *VersionManager* is called up (for a detailed description of the *VersionManager* refer to chapter 1 of the CMU operating manual or to the on-line help accessible via *Info):*

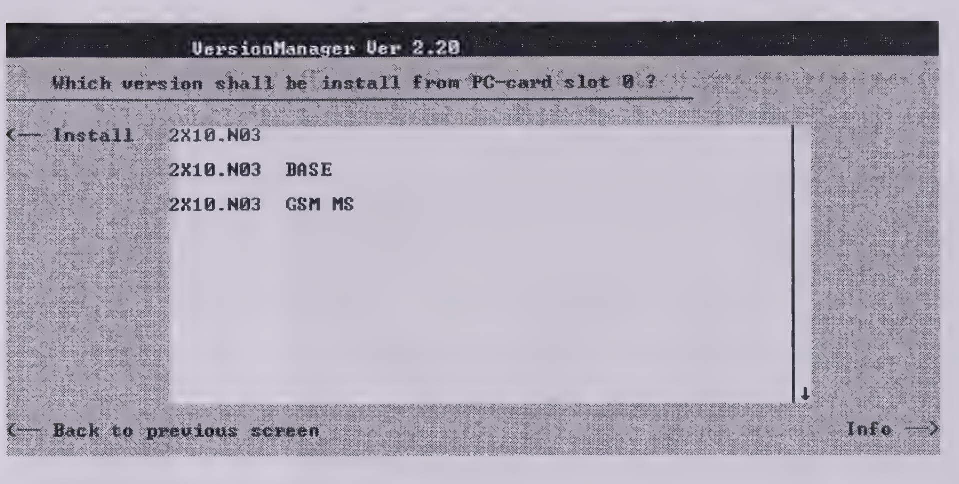


```
                     VersionManager Ver 2.20
   the active CMU base software is the version: 2V20

<— Activate other software                         Write log files to disk —>

<— Delete software                                Delete non volatile ram —>

<— Install software from PC-card slot 0                         Scan disk —>

<— List software                                 List all versions to disk —>

<— Firmware update after board change         Copy non volatile ram to disk —>

<— Edit service tables                                   Defragment disk -->
<— Exit                                                             Info —>
```

Softkey no. 5 on the left softkey bar, *Install software...*, is used to install new software from an external storage medium. The CMU automatically recognizes the storage medium and indicates the corresponding slot number: Slot 0 or 1 denotes the left or right slot of the PCMCIA interface. If a floppy disk is used the menu option reads *Install software version <version> from floppy.*

- ➢ Press left softkey no. 5 *(Install software...)* to start the installation.

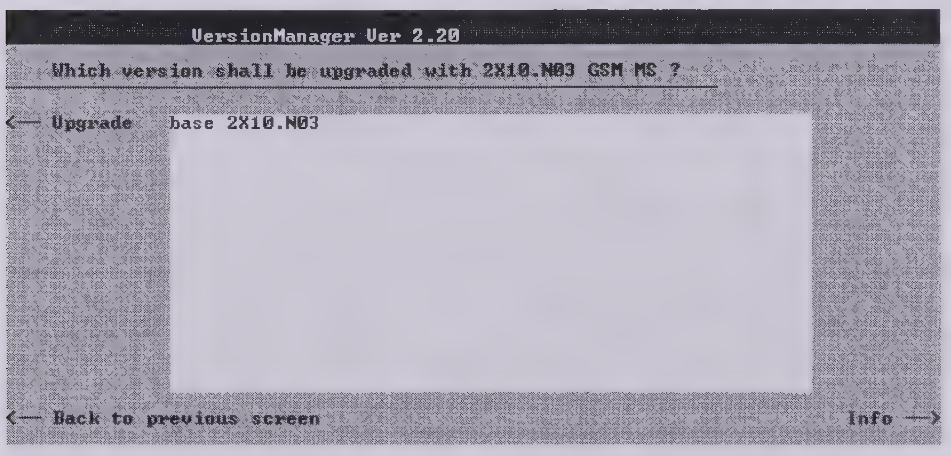
If your storage medium contains several installation versions, the software version selection dialog is opened:



```
VersionManager Ver 2.20
Which version shall be install from PC-card slot 0 ?

<— Install   2X10.N03
             2X10.N03  BASE
             2X10.N03  GSM MS

<— Back to previous screen                          Info —>
```

- ➢ Use the rotary knob or the cursor keys to scroll the list and select the *WCDMA* software version you intend to install.
- ➢ Press *Install* to start the installation.

The installation is started. To be operable on your instrument, a network option must be combined with a compatible version of the CMU base software. Any base software version installed on the CMU hard disk can be combined with one or several network options to form an independent software configuration. If none of the configurations is compatible to the new *WCDMA* option, the *VersionManager* displays an error message and takes you back to the software selection dialog; see section *Creating a new Software Configuration* on page 1.4. Otherwise, the following upgrade selection dialog is opened:



```
VersionManager Ver 2.20
Which version shall be upgraded with 2X10.N03 GSM MS ?

<— Upgrade   base 2X10.N03

<— Back to previous screen                          Info —>
```

The upgrade selection dialog displays a list of base software versions that can be combined with the new *WCDMA* software.

- ➢ Select the appropriate base version and press *Upgrade*.

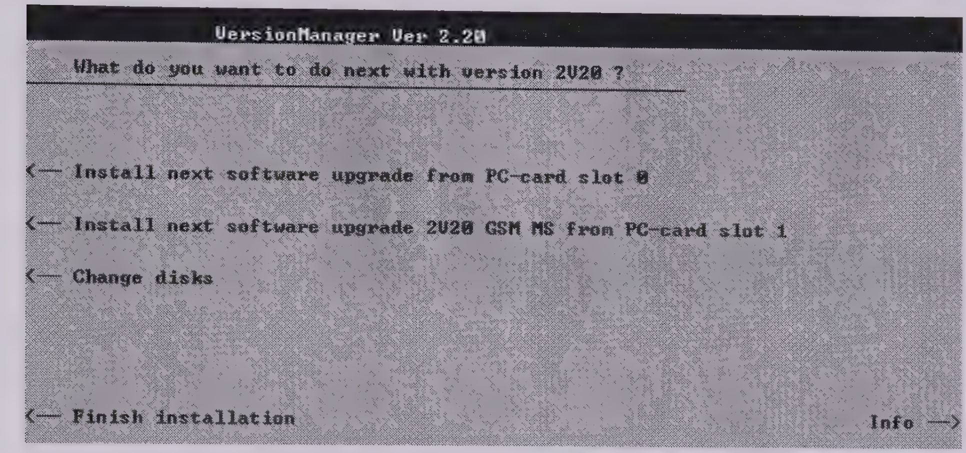
The new *WCDMA* option is added to the configuration or updates the previous *WCDMA* version of the configuration. To indicate that the storage medium must be changed the CMU issues the *Change volume* message:

```
Change volume
Process next volume

Exit
```

- ➢ Replace the current disk with the disk requested.

- Use the cursor up/down keys to select “Process next volume” (default setting).
- Press *ENTER* to confirm that the new disk has been inserted and to continue the installation.

After processing the last disk the CMU displays the following screen:



VersionManager Ver 2.20

What do you want to do next with version 2V20 ?

<— Install next software upgrade from PC-card slot 0
<— Install next software upgrade 2V20 GSM MS from PC-card slot 1
<— Change disks
<— Finish installation
Info —>

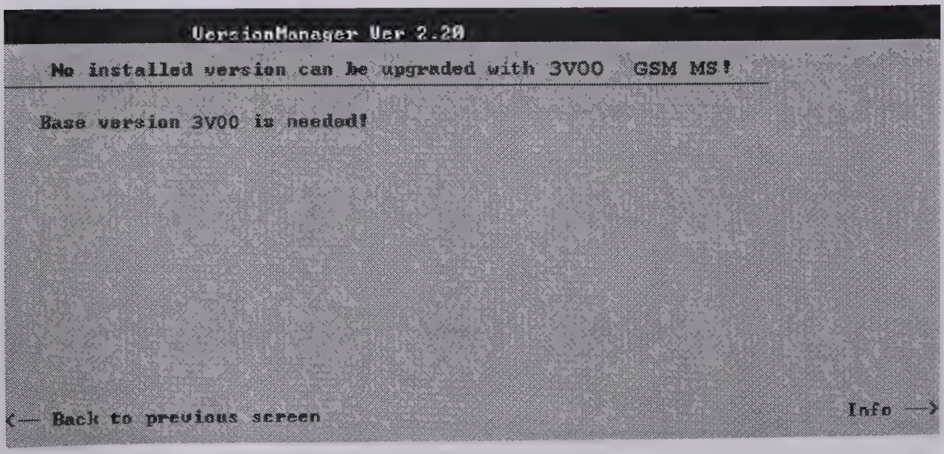
- If you wish to install or upgrade other software versions, press left softkey no 4 or 5 *(Install next software...)* or insert new storage medium into the PCMCIA slot or floppy disk drive and press *Change disks*.
- To finish the installation, remove all disks from the drive and press *Finish installation*.

The *VersionManager* is closed and the CMU is rebooted. The new firmware options are now operational and listed in the *Menu Select* menu together with their version number. Besides, the last software configuration installed is automatically taken as the active one in the next measurement session.

Creating a new Software Configuration

The CMU handles base software versions and network options on a separate basis. Different versions of the base software can be combined with different options to create new firmware configurations. For example, it is possible to update the base software without affecting the associated network options or vice versa. Moreover, the same base software version can be installed several times and combined with different network options (and vice versa), so it may enter into several firmware configurations.

If no compatible base software version can be found on the hard disk, then the CMU will refuse to install a new *WCDMA* software option selected in the software selection dialog (see previous section). Instead, it displays the following error message:

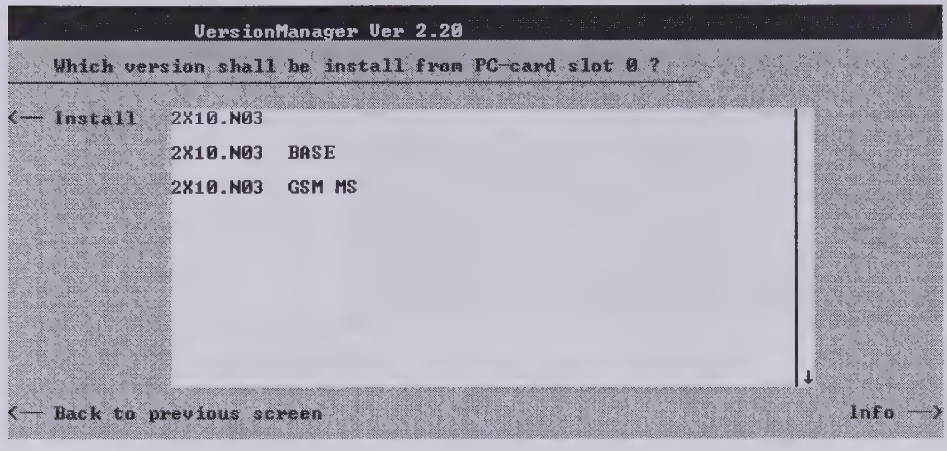


VersionManager Ver 2.20

No installed version can be upgraded with 3V00 GSM MS!

Base version 3V00 is needed!

- Press *Back to installation* to return to the software version selection dialog.

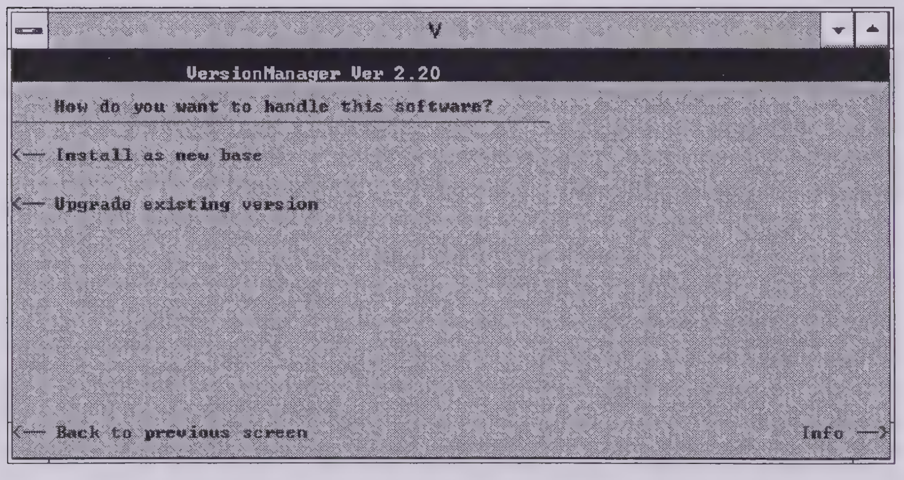


```
VersionManager Ver 2.20
Which version shall be install from PC-card slot 0 ?

<— Install   2X10.N03
             2X10.N03  BASE
             2X10.N03  GSM MS

<— Back to previous screen                       Info —>
```

- Select a base software version that is compatible to your *WCDMA* software option and press *Install*.

Note: *As a rule, firmware versions for the base system and for network options are compatible if they differ only in the last digit. WCDMA UE firmware versions 3.10 to 3.19 (if available) can be run together with base system version 3.10 to 3.19 (if available).*

With a new base software version, it is possible to either update an existing configuration or create a new one. A dialog to select between the two alternatives is opened:

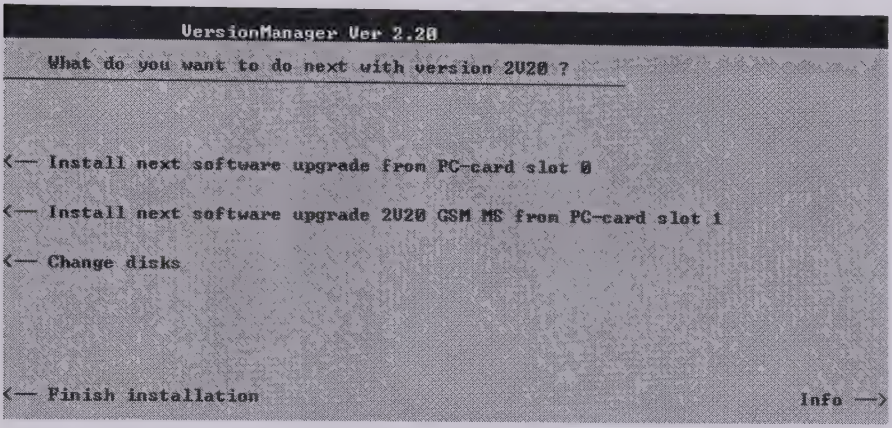


```
V
VersionManager Ver 2.20
How do you want to handle this software?

<— Install as new base

<— Upgrade existing version

<— Back to previous screen                       Info —>
```

Note: *This dialog is skipped if the new base software version is not compatible with any of the existing configurations. An incompatible new base software must be installed as a new base software.*

- If you wish to add a new configuration to your hard disk, press *Install as new base*.
- To upgrade an existing configuration with the selected base software version in order to make it compatible to the new *WCDMA* software option, press *Upgrade existing version*. The existing version to be upgraded must be selected in an additional dialog.

The installation is performed as described in section *Software Installation or Update* on p. 1.2 ff. After adding the new base software as a new configuration or updating the existing configuration, the CMU displays the following screen:



VersionManager Ver 2.20

What do you want to do next with version 2U20 ?

<— Install next software upgrade from PC-card slot 0

<— Install next software upgrade 2U20 GSM MS from PC-card slot 1

<— Change disks

<— Finish installation

Info —>

- Press left softkey no 4 or 5 *(Install next software...)* and proceed as described in section *Software Installation or Update* on p. 1.2 ff. to install the new *WCDMA* version and assign it to the new configuration.

Enabling Software Options

A new CMU software option purchased is ready to operate after it is enabled by means of a key code supplied with the option. This key code is to be entered into the *Option Enable* popup window which in turn can be opened via from the *Setup – Options* menu. For details refer to Chapter 4 of the CMU200 operating manual.

Note: *Software installation and enabling of software options are completely independent from each other. Option CMU-K66,* WCDMA (3GPP/FDD, DL) Generator, *and options CMU-K67/.../-K69,* WCDMA UE Band III/I/II Signalling, *are included in the WCDMA software package CMU-K65. There is no need to install these options separately; however, they must be enabled by means of a separate key code supplied with the option.*

Contents

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Preparing a WCDMA UE TX Test 2.2

Non Signalling Measurements 2.6
- Power Measurements 2.6
- Modulation Measurements 2.12
- Application Example for P/Slot Table 2.16
- CMU and UE Configuration for Receiver Quality Tests 2.18

WCDMA Signalling 2.21
- Accelerating the Connection 2.22

2 Getting Started

The following chapter presents a sample WCDMA UE test with the universal radio communication tester CMU200 and the WCDMA UE software options CMU-K65/.../-K69. It is intended to provide a quick overview of the function groups and to lead through the most common tests which are performed on a WCDMA UE.

Before starting any measurement with the CMU, please note the instructions given in Chapter 1 of the operating manual for the CMU basic unit for putting the instrument into operation. In Chapters 2 to 4 of that manual you will also find information on customizing the instrument and the display according to your personal preferences. Installation instructions for the WCDMA UE software options (CMU-K65/.../-K69) can be found in Chapter 1 of the present manual.

The tests reported below include

- Connection of the UE and selection of function group
- *Power* measurements and basic settings in *Non Signalling* mode
- *Modulation* measurements in *Non Signalling* mode
- *Receiver Quality* measurements in *Non Signalling* mode
- Signalling parameters and call setup

The steps to perform are explained on the left side of each double-page together with the results obtained on the CMU screen. On the right side, additional information is given. We also point out alternative settings and related measurements which could not be reported in detail.

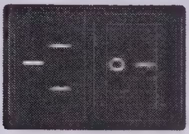
The principles of manual operation are discussed in Chapter 3. For a systematic explanation of all menus, functions and parameters refer to the reference part in Chapter 4.

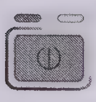
Note: *The WCDMA DL generator (option CMU-K66, WCDMA (3GPP/FDD, DL) Generator) can be configured in the* Generator *tab of the* Connection Control *menu. The functionality and use of the option is described in Chapter 4, section* Generator Settings.

The Signalling function groups (options CMU-K67/.../-K69) are accessed from the Menu Select *menu. See section WCDMA Signalling on p. 2.21 ff.*

Preparing a WCDMA UE TX Test

This chapter describes how to use the CMU200 for WCDMA UE TX tests. As a prerequisite for starting the session, the instrument must be correctly set up and connected to the AC power supply as described in Chapter 1 of the CMU operating manual. Furthermore, the WCDMA UE software options must be properly installed following the instructions given in Chapter 1 of the present manual. The measurement example described in this and the following sections require option R&S CMU-K65.

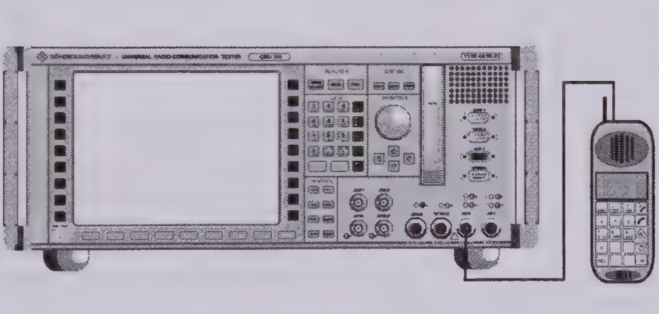




Step 1

- ➢ Switch on the CMU using the mains switch at the rear. ①
- ➢ Check the operating mode of the instrument at the *ON/STANDBY* key on the front panel.②

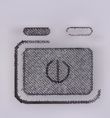
⇓



Step 2

- ➢ Connect the bi-directional RF connector RF 2 of the CMU to the antenna connector of the WCDMA UE. ③
- ➢ Make sure that the WCDMA UE is supplied with the correct operating voltage (battery or power supply) and switched on.. ④

⇓



- ➢ Switch on the CMU by pressing the *ON/STANDBY* key on the front panel.

⇓

Additional Information...

... on Step 1

① **Mains switch on the rear panel**

When the mains switch at the rear is set to the OFF position, the complete instrument is disconnected from the power supply. When the mains switch is set to the ON position, the instrument is in standby mode or in operation, depending on the position of the power switch on the front panel.

② ***ON/STANDBY* key on the front panel**

The *ON/STANDBY* key at the front of the instrument determines whether the instrument is in standby mode or in operation.

Standby mode:
Only the reference frequency oscillator is supplied with operating voltage, and the yellow LED (STANDBY) is illuminated.

Operation:
The green LED (ON) is illuminated and all modules of the instrument are supplied with operating voltage.

... on Step 2

③ **RF connection of the WCDMA UE**

A high-quality coax cable should be used for this connection, ideally with an attenuation of less than 0.5 dB.

The CMU provides two bi-directional RF connectors RF1 and RF2 differing by their input and output level ranges. RF2 is the recommended standard connector for WCDMA UEs.

The unidirectional connectors RF4 IN and RF3 OUT are intended for connection of modules requiring high input levels or modules with low RF output levels. RF4 IN and RF3 OUT can also be used to connect WCDMA UEs off the air via antennas.

④ **Output signal of the WCDMA UE**

The purpose of function group is to analyze RF signals with 3GPP WCDMA characteristics and to check whether the output signal of an UE transmitter conforms to 3GPP specifications. The analyzed signal may be:

- A single QPSK-modulated signal with a chip rate of 3.84 Mcps
- An uplink WCDMA signal containing one DPCCH plus up to 6 DPDCHs, multiplexed according to 3GPP specifications.

Some measurement menus and parameters can differ according to the configuration of the analyzed signal.

Alternative Settings and Measurements

☞ Chapter 1 of CMU manual

☞ Chapter 1 of CMU manual

☞ Chapter 4

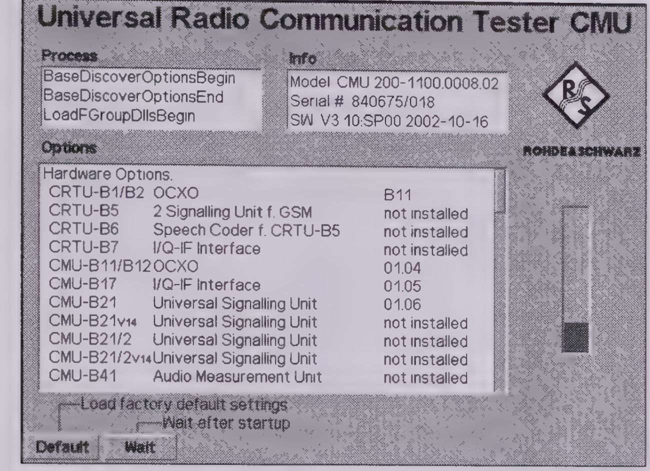
Input and output connectors can be selected in the *AF/RF* ⊖→ tab of the *Connect. Control* menu.

☞ Chapter 4, p.

Some measurement menus and parameters differ according to the configuration of the analyzed signal (QPSK or WCDMA). E.g. the *Modulation* measurement can be accelerated if the analyzed signal is known to be a single QPSK signal.

Note: *A signal containing 7 or more DPDCHs cannot be measured in* Modulation *or* Code Domain Power *measurements. The excess DPDCHs are treated as noise.*

Step 3


Universal Radio Communication Tester CMU
Process
Info
ROHDE&SCHWARZ
Options
Load factory default settings
Wait after startup
Default
Wait

BaseDiscoverOptionsBegin
BaseDiscoverOptionsEnd
LoadFGroupDllsBegin

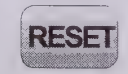
Model CMU 200-1100.0008.02
Serial # 840675/018
SW V3 10:SP00 2002-10-16

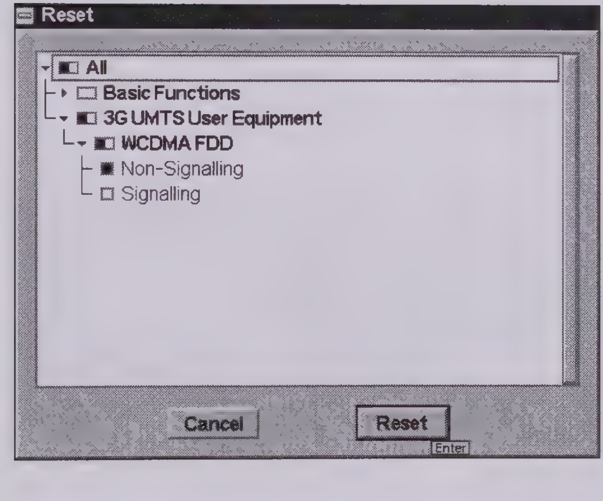
Hardware Options.

CRTU-B1/B2	OCXO	B11
CRTU-B5	2 Signalling Unit f. GSM	not installed
CRTU-B6	Speech Coder f. CRTU-B5	not installed
CRTU-B7	I/Q-IF Interface	not installed
CMU-B11/B12	OCXO	01.04
CMU-B17	I/Q-IF Interface	01.05
CMU-B21	Universal Signalling Unit	01.06
CMU-B21v14	Universal Signalling Unit	not installed
CMU-B21/2	Universal Signalling Unit	not installed
CMU-B21/2v14	Universal Signalling Unit	not installed
CMU-B41	Audio Measurement Unit	not installed

The startup menu is displayed while the CMU performs a power-up test. ⑤

After a few seconds the CMU displays the last menu used in the previous session.

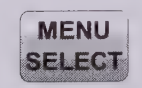



Reset
All
Basic Functions
3G UMTS User Equipment
WCDMA FDD
Non-Signalling
Signalling
Cancel
Reset
Enter

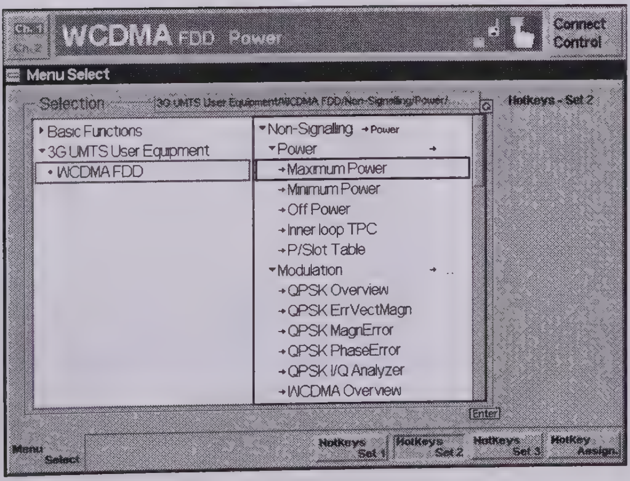
- ➢ Press the RESET key to open the Reset popup menu.
- ➢ Proceed as described in Chapter 4 of the CMU200/300 operating manual, section *Reset of Instrument Settings*, to expand the tree of function groups.
- ➢ Select the function group *WCDMA FDD Non Signalling* to be reset (the corresponding nodes must be black).
- ➢ Use the cursor keys to activate the *Reset* button and press *ENTER*. In the popup box opened *(Are you sure?)*, select *Yes* to confirm the reset.

The CMU indicates that it performs a partial reset of the selected function group and is then ready to carry out the following steps. The *Reset* popup menu is closed automatically.

Step 4


MENU
SELECT

⇓


Ch.1
Ch.2
WCDMA FDD Power
Connect Control
Menu Select
Selection
3G UMTS User Equipment/WCDMA FDD/Non-Signalling/Power/
Hotkeys - Set 2
Basic Functions
3G UMTS User Equipment
WCDMA FDD
Non-Signalling → Power
Power →
→ Maximum Power
→ Minimum Power
→ Off Power
→ Inner loop TPC
→ P/Slot Table
Modulation → ..
→ QPSK Overview
→ QPSK ErrVectMagn
→ QPSK MagnError
→ QPSK PhaseError
→ QPSK I/Q Analyzer
→ WCDMA Overview
Enter
Menu Select
HotKeys Set 1
HotKeys Set 2
HotKeys Set 3
HotKey Assign.

- ➢ Press the *Menu Select* key to open the *Menu Select* menu.⑥

The *Menu Select* menu indicates the function groups available. If a function group is selected the corresponding modes and measurement menus are indicated.

- ➢ Select the *WCDMA FDD* function group.
- ➢ Select the *Non Signalling* test mode.
- ➢ Select the *Power* measurement menu.
- ➢ Press the *Enter* key to activate the measurement selected and open the *Power* menu.

Additional Information...

... on Step 3

⑤ **Startup menu**

The startup menu displays the following information:

- The status of the startup test *(Process)*
- The device name, serial number and software version *(Info)*
- The options and equipment installed *(Options)*
- The progress of the startup test (*Startup* bar graph)

Before starting a measurement, a reset is recommended to set the instrument with all its functions into a definite state.

... on Step 4

⑥ **Menu Select menu**

The *Menu Select* menu shows all function groups installed on your CMU. Function groups and menus that are often needed can be assigned to a softkey/hotkey combination in the *Menu Select* menu, so they can be accessed by a single key stroke.

Function group is subdivided in the two measurement modes *Non Signalling* and *Signalling*, each containing a number of measurement menus. Each measurement group is divided into several applications that are displayed in the right half of the table.

Alternative Settings and Measurements

☞ Chapter 4 of CMU manual

That chapter also contains information on customizing the CMUe.g. by setting the date and time zone, selecting the printer etc.

☞ Chapter 4 of CMU manual

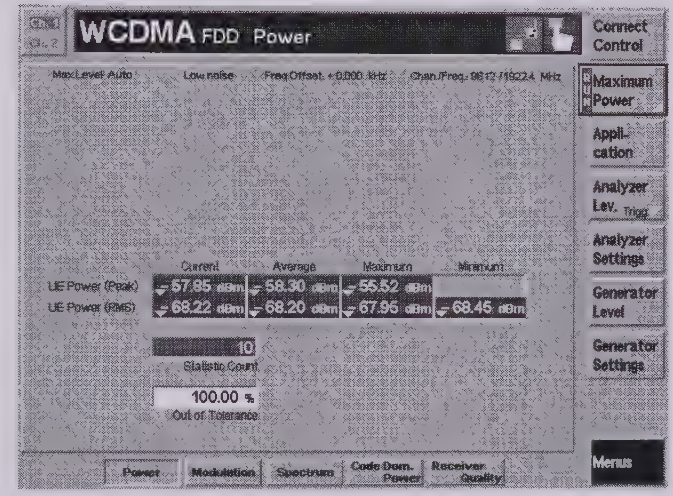
For an overview of the menu structure of the WCDMA UE function groups see Chapter 3 of the present manual.

Non Signalling Measurements

In the *Non Signalling* mode, the CMU generates a downlink WCDMA signal (option CMU-K66) and analyzes the uplink WCDMA signal transmitted by the DUT. Compared to the *Signalling* mode test times may be reduced considerably. Moreover, the measurements are not restricted to the specified channel and UE output power ranges of the network. The most common application is module test. Besides the measurements in the two test modes are largely analogous.

Power Measurements

As described above, all measurement menus can be called up from the *Menu Select* menu. Once a measurement menu is opened, the hotkeys across the bottom of the menu can be used to switch over to any of the other measurements.



Ch. 1
Ch. 2
WCDMA FDD Power
Connect Control
Maximum Power
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Menus
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

Max.Level: Auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz

	Current	Average	Maximum	Minimum
UE Power (Peak)	-57.85 dBm	-58.30 dBm	-55.52 dBm	
UE Power (RMS)	-68.22 dBm	-68.20 dBm	-67.95 dBm	-68.45 dBm

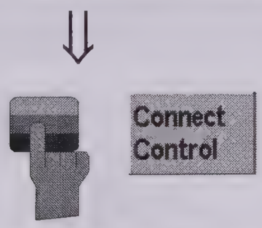
Statistic Count: 10

Out of Tolerance: 100.00 %

Step 1

The *Power* menu shows the power of the received RF carrier signal. ①

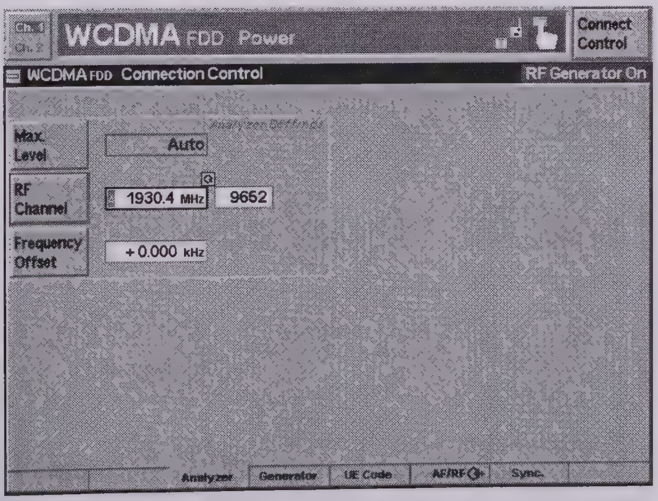
The results are presented in a table containing the peak and RMS-averaged power in the current slot plus a statistical evaluation of these peak and RMS powers. To obtain valid and reasonable measurement results, the RF analyzer of the CMU must be set to be in accordance with the properties of the RF input signal.



Connect Control

Step 2

- ➢ Press the *Connect Control* softkey on top of the right softkey bar to open the *Connection Control* popup menu.



Ch. 1
Ch. 2
WCDMA FDD Power
Connect Control
WCDMA FDD Connection Control
RF Generator On
Analyzer Settings
Max. Level
RF Channel
Frequency Offset
Analyzer
Generator
UE Code
AF/RF
Sync.

Max. Level: Auto

RF Channel: 1930.4 MHz 9652

Frequency Offset: + 0.000 kHz

The *Connection Control* menu configures the RF analyzer and the output connectors of the CMU and defines the properties of the input signal that can be measured. At present, the *Analyzer* tab is active. The other tabs of the *Connection Control* menu are accessible via the hotkeys across the bottom of the menu. ②

The field next to the *Max. Level* softkey shows *Auto* indicating that the input path is automatically adapted to the peak envelope power (PEP) of the applied signal. ③

- ➢ Press the RF Channel softkey and set the RF channel number equal to the channel number of the input signal. ④

Additional Information...

... on Step 1

① **Power menu**

The *Power* menu shows the peak output power of the UE *(UE Power (Peak)),* i.e. the Peak Envelope Power (PEP) of the WCDMA signal and the output power averaged over the transmit slot *(UE Power (RMS))*. The PEP is usually a few dB higher than the RMS-averaged WCDMA signal power; the level difference is termed crest factor.

Both the *UE Power (Peak)* and the *UE Power (RMS)* can be measured in various operating modes of the UE. In the *Maximum Power* mode, the UE is expected to transmit at its maximum power control level.

For various reasons, an output field may fail to show a valid measurement result (indication "---" or a red output field, if the results exceeds the tolerances):

- The analyzer settings do not match the properties of the input signal.
- The input signal is missing.
- The measurement is switched off *(OFF* is indicated in the softkey controlling the measurement).

... on Step 2

② **Connection Control menu**

The *Connection Control* menu provides general settings that are valid for all WCDMA measurements. Part of the settings can be overwritten in the individual measurement groups.

The left half of the softkey-oriented version of the *Analyzer* tab contains a panel for configuration of the RF analyzer. The *Analyzer* hotkey switches between the softkey-oriented version of the tab and a table-oriented version with extended functionality. A yellow triangle on a hotkey indicates that the hotkey toggles between different menus.

③ **Max. Level**

The *Max. Level* softkey sets the maximum RF input power which can be measured and is used to adjust the RF input path to the expected power of the measured signal. The permissible range *Max. Level* depends on the RF connector and the external attenuation used.

④ **WCDMA Channels**

The assignment between carrier frequencies and channel numbers (UARFCN, UTRA Absolute Radio Frequency Channel Number) is according to 3GPP specifications. The analyzed signal represents an uplink signal (signal transmitted by the WCDMA UE and received by the Node B / base station). However, the CMU is not restricted to the designated uplink band between 1920 MHz and 1980 MHz (Operating Band I).

Alternative Settings and Measurements

☞ Chapter 4.

In addition to *Maximum Power*, three other operating modes of the UE (applications) are provided.

In the *Minimum Power* mode, the UE transmits on its minimum power control level.

In the *Off Power* mode, the UE transmitter is set to the transmit OFF power.

In the *Inner Loop TPC* mode, the UE transmitter is set to change its output power with variable step size.

All modes can be selected by means of the *Application* softkey (see also note on *Applications* on p. 2.13). The UE must be set to comply to the CMU settings.

☞ Chapter 4

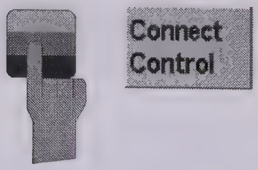
To facilitate and speed up the operation, many CMU settings are accessible from different menus. The RF analyzer settings can be accessed via the *Analyzer Level* and *Analyzer Settings* softkeys in the *Power* measurement menu as well.

☞ Chapter 4

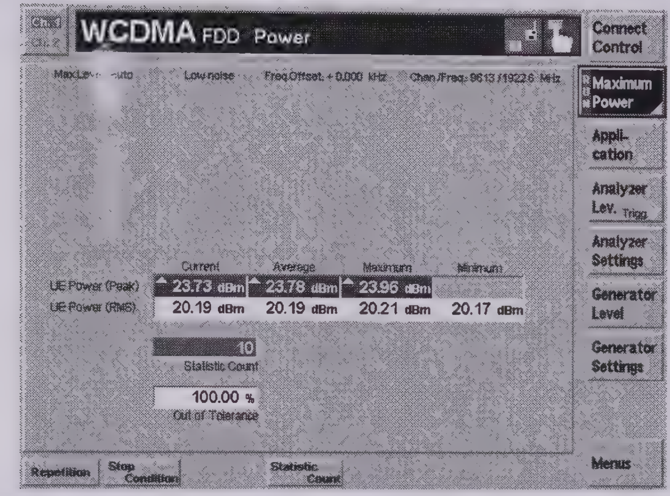
The RF *Max. Level* can also be set in all measurement menus (softkey *Analyzer Level*, hotkey *Max. Level)*.

☞ Chapter 4

The RF frequency can be set in multiples of 200 kHz. With an additional *Frequency Offset*, an RF signal with an arbitrary frequency that is in the range supported by the tester can be analyzed.


Connect
Control

- ➢ Press the *Escape* key or the *Connect Control* softkey again to close the *Connection Control* popup menu and return to the *Power* menu.


WCDMA FDD Power
Connect Control
Maximum Power
Appli-cation
Analyzer Lev. Trigg.
Analyzer Settings
Generator Level
Generator Settings
Menus
Repetition
Stop Condition
Statistic Count

MaxLev.: auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 9613 / 1922.6 MHz

	Current	Average	Maximum	Minimum
UE Power (Peak)	23.73 dBm	23.78 dBm	23.96 dBm	
UE Power (RMS)	20.19 dBm	20.19 dBm	20.21 dBm	20.17 dBm

Statistic Count: 10

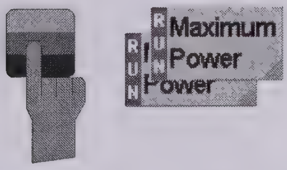
Out of Tolerance: 100.00 %

Step 3

The peak and average slot power of the RF carrier signal is now indicated in the output fields associated to the *Power* softkey.

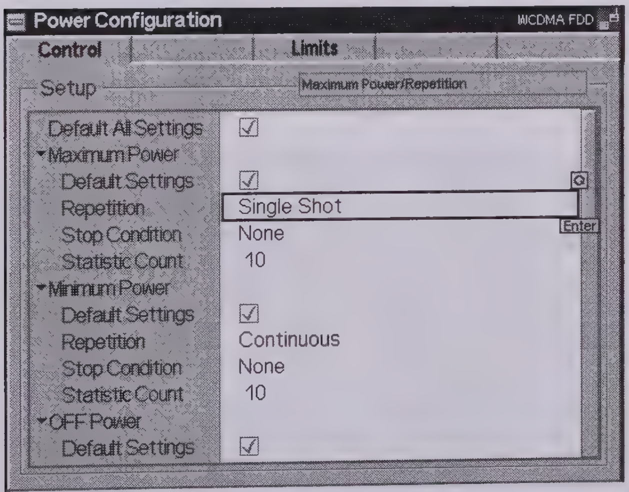
If a result exceeds the error tolerances, the corresponding output field turns red, and an arrow pointing upwards/downwards indicates that the result is above/below the limit. In out example, the average output power of the DUT *(UE Power (RMS))* matches the limit whereas the *UE Power (Peak)* is too high.

The analyzer settings from the *Connection Control* menu are displayed in a parameter line above the diagram. The *Maximum Power* softkey indicates the measurement state *RUN.* ①


RUN
Maximum
Power
RUN
Power

Step 4

- ➢ Select (press) the *Maximum Power* softkey.
- ➢ Press the selected *Maximum Power* softkey again to call up the *Power Configuration* menu. ②


Power Configuration
WCDMA FDD
Control
Limits
Setup
Maximum Power/Repetition
Enter

Default All Settings	☑
▾Maximum Power	
Default Settings	☑
Repetition	Single Shot
Stop Condition	None
Statistic Count	10
▾Minimum Power	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
▾OFF Power	
Default Settings	☑

The *Control* tab of the *Power Configuration* menu defines the scope of the *Power* measurement. To pick just one example of the settings, we limit the number of slots measured and adjust the tolerance limits to the expected properties of our WCDMA signal.

- ➢ Press the *ON/OFF* key to expand the menu tables.
- ➢ Select *Single Shot* in the *Repetition* table line of the *Maximum Power* section.③

Additional Information...

... on Step 3

① **Measurement State**

The state indication of the different measurements is included in the measurement control softkeys (2nd softkey in the right softkey bar of each measurement menu). For ongoing measurements *(RUN* state), the results in the output fields are constantly updated.

A measurement can be switched on and off after selecting the measurement control softkey by means of the toggle key *ON/OFF*.

... on Step 4

② **Power Configuration menu**

The *Power Configuration* menu contains two tabs defining

- The scope of the measurement *(Control)*
- The tolerances of the results *(Limits)*

Analogous configuration popup menus are available for all measurement groups. Settings pertaining to different measurement applications are grouped together in separate sections of the configuration menus.

③ **Repetition mode and Stop Condition**

The *Repetition* mode determines whether the measurement is

- Continued until it is explicitly stopped by the operator *(Continuous)*
- Stopped after one statistic count *(Single Shot)*

By default, a statistic count comprises 10 basis evaluation periods. In the *Power* measurement, an evaluation period corresponds to 1 WCDMA slot with a duration of 10/15 ms comprising 2560 chips.

Alternative Settings and Measurements

☞ CMU manual.

See the sections on measurement control in Chapter 3 and 5.

The options for the measurement state are *RUN* (default) and *OFF*. A third state, *HLT*, occurs after a single-shot measurement is terminated (see p. 2.11).

☞ Chapter 3.

Settings made in the *Power Configuration* menu apply to power measurements only.

Settings made in the *Connect. Control* menus apply to the entire function group.

☞ Chapter 3.

In addition, the running measurement can be stopped after the first slot which is out of tolerance. To this end, *Stop Condition = On Limit Failure* must be selected.

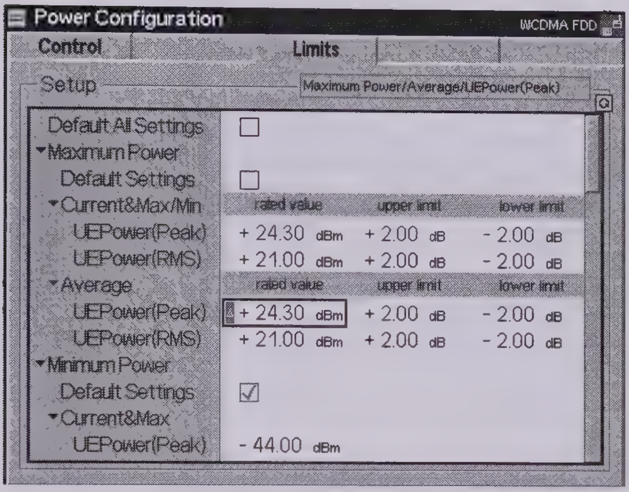
This is suitable if the limit check represents the main purpose of the measurement.

Step 5

The *Limits* tab of the *Power Configuration* menu defines the rated values and the upper and lower limits for the peak and RMS power measured. ①

- ➢ Press the *ON/OFF* key to expand the menu tables.
- ➢ Adapt the *rated value* of the *UE Power (RMS)* to the power class of your DUT and allow for a crest factor corresponding to the analyzed signal. ②
- ➢ Press the *ESCAPE* key to close the *Power Configuration* menu and return to the main menu.

⇓



Power Configuration WCDMA FDD

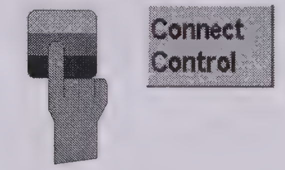
Control | Limits

Setup: Maximum Power/Average/UEPower(Peak)

Default All Settings	☐		
▾Maximum Power			
Default Settings	☐		
▾Current&Max/Min	rated value	upper limit	lower limit
UEPower(Peak)	+ 24.30 dBm	+ 2.00 dB	- 2.00 dB
UEPower(RMS)	+ 21.00 dBm	+ 2.00 dB	- 2.00 dB
▾Average	rated value	upper limit	lower limit
UEPower(Peak)	+ 24.30 dBm	+ 2.00 dB	- 2.00 dB
UEPower(RMS)	+ 21.00 dBm	+ 2.00 dB	- 2.00 dB
▾Minimum Power			
Default Settings	☑		
▾Current&Max			
UEPower(Peak)	- 44.00 dBm		

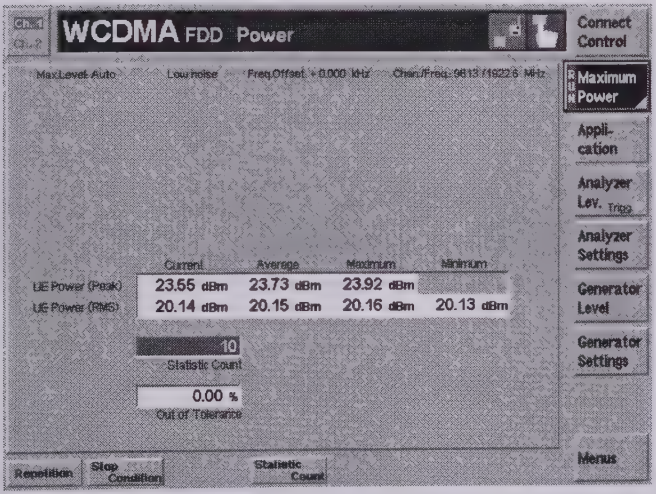
⇓

Step 6


Connect
Control

- ➢ Press the *Escape* key or the *Connect Control* softkey again to close the *Power Configuration* popup menu and return to the *Power* menu.

⇓


Ch.1
Ch.2
Connect Control
RUN Maximum Power
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Menus
Repetition
Stop Condition
Statistic Count

WCDMA FDD Power

Max.Level: Auto   Low noise   Freq.Offset: + 0.000 kHz   Chan./Freq.: 9613 / 1922.6 MHz

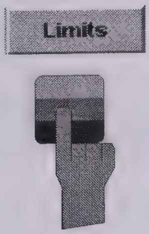
	Current	Average	Maximum	Minimum
UE Power (Peak)	23.55 dBm	23.73 dBm	23.92 dBm	
UE Power (RMS)	20.14 dBm	20.15 dBm	20.16 dBm	20.13 dBm

Statistic Count: 10

Out of Tolerance: 0.00 %

The *Power* measurement is stopped after one statistics cycle. The status indication next to the *Power* softkey is set to *HLT*. ③

The *UE Power (RMS)* measurement passed the limit check so the output fields are no longer red.



- ➢ Press the *Limits* key to activate the *Limits* tab of the configuration menu.

Additional Information...

Alternative Settings and Measurements

... on Step 5

① WCDMA Maximum Output Powers

WCDMA equipment is divided into four power classes. For each power class the 3GPP standard defines the maximum output power of the UE transmitter and its tolerance. E.g. for power class 4 the maximum output power (rated value) is +21 dBm with a tolerance of ±2 dB.

The maximum output power corresponds to the *UE Power (RMS)* measured in the *Maximum Power* application. In the *Limits* tab, the *rated value* and the tolerance *(upper limit, lower limit)* can be set in *UE Power (RMS)* row of the *Maximum Power – Current & Max./Min.* section.

☞ Chapter 4

The *rated value* and the tolerance values *(upper limit, lower limit)* set in *Current & Max./Min.* sections of the *Limits* tab apply to the measurement results in the *Current*, *Maximum* and *Minimum* columns of the output table in the *Power* measurement menu. Different values can be set for the *Average* results (e.g. smaller upper and lower limits corresponding to the smaller variation of the *Average* results).

② Peak and RMS powers

The superposition of several channels to a composite WCDMA signal enhances the variations of the power in time and leads to a peak to average ratio (crest factor) that is higher than in conventional TDMA systems. The crest factor varies with the signal configuration (i.e. the number of active channels and their channelization codes) and on the data content of the channels. As a consequence, the *UE Power (Peak)* limits must generally be adjusted to the RMS limits and the properties of the analyzed signal.

☞ Chapter 4

③ Measurement in the HLT state

The state indication of the different measurements is included in the measurement control softkeys (2nd softkey in the right softkey bar of each measurement menu). In the single shot mode (i.e. if the *Repetition* mode is set to *Single Shot)* the measurement is stopped after each statistics cycle and assumes the *HLT* state. The next single shot measurement can be initiated by pressing the toggle key *ON/OFF*.

Note that with remote control, the most common (and default) repetition mode is *Single Shot*, while manual measurements are generally performed in *Continuous* mode.

☞ CMU200 manual

See the sections on measurement control in Chapter 3 and 5.

Out-of-tolerance power measurements

If a power measurement is out of tolerance, please first ensure that the attenuation of any cables and/or antenna couplers used is being taken into account by the CMU. As the power levels must be within a 4 dB range around the rated value, even a small attenuation can result in an out-of-tolerance measurement.

External attenuation values for each input may be entered in the *RF* ⊖ tab of the *Connect. Control* menu.

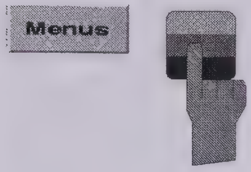
The cables, RF connections and antenna couplers must also be in good condition for satisfactory measurements. Dirty or broken RF connections can cause problems at the high frequencies used by WCDMA networks.

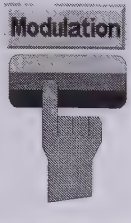
Modulation Measurements

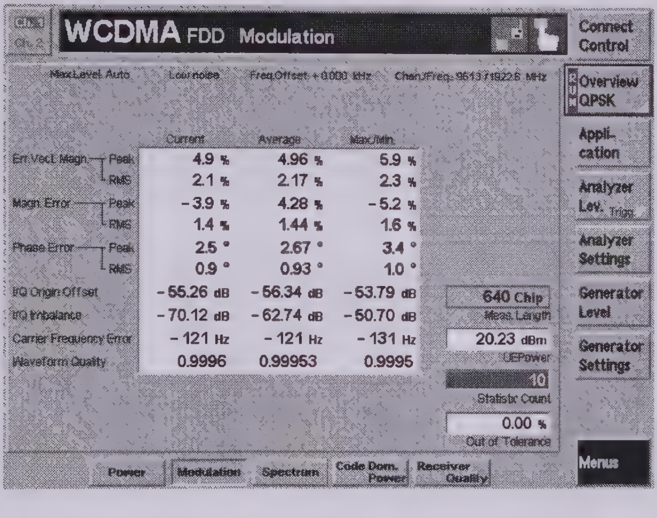
To switch over to the *Modulation* measurement, we use the hotkey bar.

Step 1

- ➢ Press the *Menus* softkey to display all measurement groups of the function group.
- ➢ Press the *Modulation* hotkey to open the *Modulation* menu.




Modulation


WCDMA FDD Modulation
Ch. 2
Connect Control
Overview QPSK
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Menus
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

Max.Level: Auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 9613 / 1922.6 MHz

		Current	Average	Max./Min.
Err.Vect. Magn.	Peak	4.9 %	4.96 %	5.9 %
	RMS	2.1 %	2.17 %	2.3 %
Magn. Error	Peak	- 3.9 %	4.28 %	- 5.2 %
	RMS	1.4 %	1.44 %	1.6 %
Phase Error	Peak	2.5 °	2.67 °	3.4 °
	RMS	0.9 °	0.93 °	1.0 °
I/Q Origin Offset		- 55.26 dB	- 56.34 dB	- 53.79 dB
I/Q Imbalance		- 70.12 dB	- 62.74 dB	- 50.70 dB
Carrier Frequency Error		- 121 Hz	- 121 Hz	- 131 Hz
Waveform Quality		0.9996	0.99953	0.9995

Meas. Length: 640 Chip
UEPower: 20.23 dBm
Statistic Count: 10
Out of Tolerance: 0.00 %

The *Modulation – Overview QPSK* menu displays the main results of the *Modulation* measurement. ①

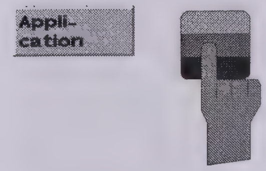
If a result exceeds the tolerances, the corresponding output field turns red, and an arrow pointing upwards/downwards indicates that the result is above/below the limit.

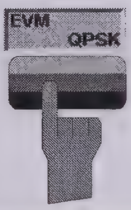
In the default setting, the measurement extends over 640 chips, corresponding to the first quarter of a WCDMA slot. The *Meas. Length* is indicated in the menu; it can be changed in the *Modulation Configuration* menu (see p. 2.14). The following diagrams are based on a *Meas. Length* of 640 chips (1/4 slot).

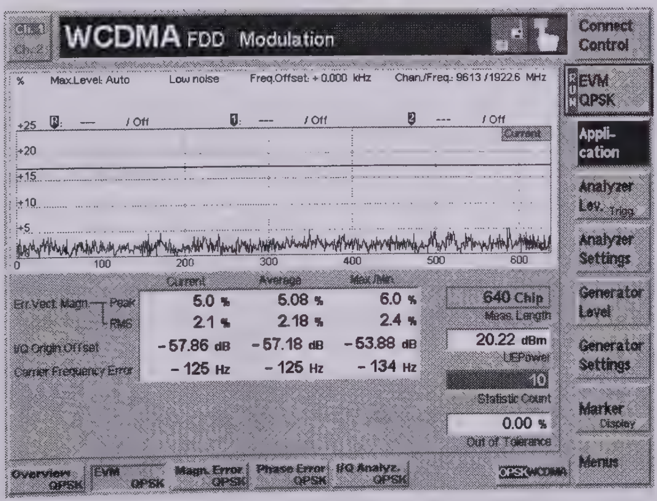
⇓

Step 2

- ➢ Press the *Application* softkey to display the different applications within the *Modulation* menu.②
- ➢ Press the *EVM QPSK* hotkey to switch over to the *EVM (Error Vector Magnitude)* application.


Appli-cation




WCDMA FDD Modulation
Ch. 1
Ch. 2
%
+25
+20
+15
+10
+5
0
100
200
300
400
500
600
R: --- / Off
1: --- / Off
2: --- / Off
Current
Connect Control
EVM QPSK
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Marker Display
Menus
Overview QPSK
EVM QPSK
Magn. Error QPSK
Phase Error QPSK
I/Q Analyz. QPSK
QPSK WCDMA

Max.Level: Auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 9613 / 1922.6 MHz

		Current	Average	Max./Min.
Err.Vect. Magn.	Peak	5.0 %	5.08 %	6.0 %
	RMS	2.1 %	2.18 %	2.4 %
I/Q Origin Offset		- 57.86 dB	- 57.18 dB	- 53.88 dB
Carrier Frequency Error		- 125 Hz	- 125 Hz	- 134 Hz

Meas. Length: 640 Chip
UEPower: 20.22 dBm
Statistic Count: 10
Out of Tolerance: 0.00 %

The *Modulation – EVM QPSK* menu displays the Error Vector Magnitude (EVM) of the current slot as a function of time. ③

The output fields below are a subset of the ones shown in the *Overview QPSK* application.

Additional Information...

.... on Step 1

① **Statistical quantities**

The table in the *Overview QPSK* menu reports peak and RMS-averaged values of quantities characterizing the errors of the modulation vector. In addition, the scalar modulation results *Origin Offset, I/Q Imbalance, Carrier Frequency Error* and *Waveform Quality* are indicated. The values in the three columns of the table are calculated as follows:

- The *Current* column contains the results for the current slot.
- The *Average* column contains the currents results referenced to the last statistics cycle.
- The *Max./Min.* column contains the extreme values of the current results for all slots measured.

... on Step 2

② **Applications**

Applications are different measurements belonging to the same measurement group. Each application is assigned its own set of configuration parameters. Therefore, the applications of a measurement group can be configured individually and serviced in parallel.

The *Modulation* menu comprises the eight applications *Overview QPSK/WCDMA, Error Vector Magnitude QPSK/WCDMA, Magnitude Error QPSK/WCDMA, Phase Error QPSK/WCDMA.*

③ **Measurement diagram**

The diagrams in the different applications of the *Modulation* menu show a measurement curve representing the EVM, the magnitude error and the phase error of the modulation vector as a function of time. The measurement curve extends over the *Meas. Length* indicated below the diagram. In the *Modulation Configuration* menu, this parameter can be set to 1 slot (chip 0 to chip 2559) or to the first quarter of a slot (chip 0 to chip 639).

The display mode of the curve *(Current)* is indicated in the right upper corner of the diagram; it can also be changed in the configuration menu; see note on *Display Mode* on p. 2.15.

The measurement menu also contains a red, horizontal line representing the limit for the measured quantity.

Alternative Settings and Measurements

☞ Chapter 3.

The averaging prescription for the different results in the table is explained in detail in Chapter 3.

☞ Chapter 4.

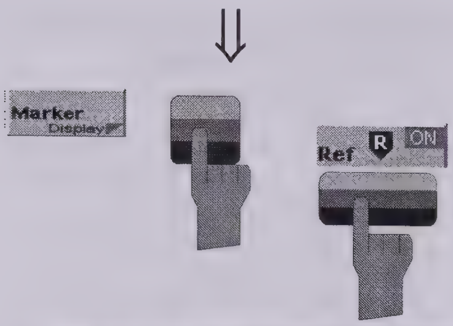
If the *Overview QPSK* measurement fails, make sure that your signal configuration is QPSK-like. A composite signal with a DPCCH plus more than one DPDCH will result in wrong results

☞ Chapter 5 of CMU200 manual

☞ Chapter 4.

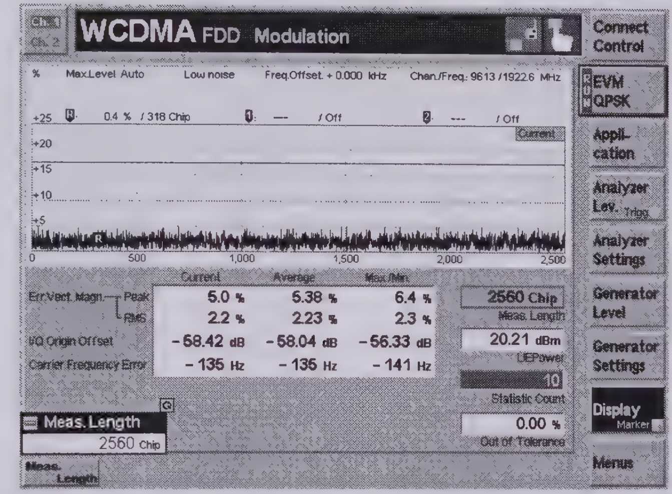
The principle of *Modulation* measurements and the measured quantities are explained at the beginning of section *Modulation Measurements.*

In the *Control* tab of the *Modulation Configuration* menu, it is possible to remove the grid in the measurement diagram.


Marker
Display
Ref
R
ON

Step 3

- ➢ Press the *Marker/Display* softkey and the *Ref. R* hotkey to open an input field for the x-axis value of the reference marker. ① ②


Ch. 1
Ch. 2
WCDMA FDD Modulation
Connect Control
EVM QPSK
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Display Marker
Menus
Meas. Length
+25
+20
+15
+10
+5
0
500
1,000
1,500
2,000
2,500
Current
R

% Max.Level: Auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 9613 / 1922.6 MHz

R: 0.4 % / 318 Chip 1: --- / Off 2: --- / Off

		Current	Average	Max./Min.
Err.Vect. Magn.	Peak	5.0 %	5.38 %	6.4 %
	RMS	2.2 %	2.23 %	2.3 %
I/Q Origin Offset		– 58.42 dB	– 58.04 dB	– 56.33 dB
Carrier Frequency Error		– 135 Hz	– 135 Hz	– 141 Hz

Meas. Length: 2560 Chip

UEPower: 20.21 dBm

Statistic Count: 10

Out of Tolerance: 0.00 %

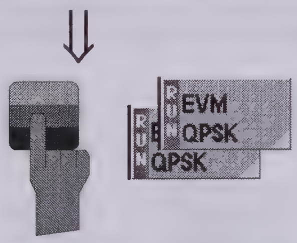
Meas. Length: 2560 Chip

- ➢ Press the *Marker/Display* softkey again.

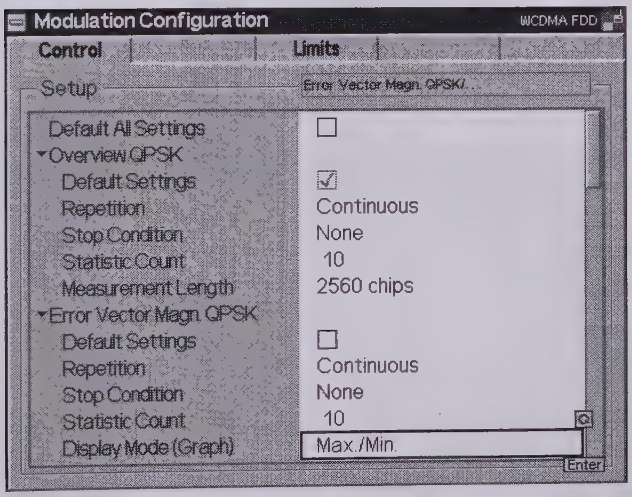
The labeling of the *Marker/Display* softkey changes to *Display/Marker*. At the same time, the hotkey bar is changed.

- ➢ Press the *Meas. Length* hotkey and change the diagram scale to 2560 bits (1 slot).

Step 4


EVM QPSK
QPSK

- ➢ Select (press) the *EVM QPSK* softkey.
- ➢ Press the selected *EVM QPSK* softkey again to call up the *Modulation Configuration* menu.


Modulation Configuration
WCDMA FDD
Control
Limits
Setup
Error Vector Magn. QPSK/...
Enter

Default All Settings	☐
▾Overview QPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Measurement Length	2560 chips
▾Error Vector Magn. QPSK	
Default Settings	☐
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Display Mode (Graph)	Max./Min.

The *Control* tab of the *Modulation Configuration* menu defines the scope of the *Modulation* measurement. Most settings are identical with the ones provided in the *Control* tab of the *Power Configuration* menu. The *Display Mode* is a parameter which only affects the measurement curves:

- ➢ Press the *ON/OFF* key to expand the menu tables.
- ➢ Select *Max./Min.* in the *Display Mode (Graph)* table line of the *Error Vector Magn. QPSK* section. ③
- ➢ Press the ESCAPE key to close the *Modulation Configuration* menu and return to the main menu.

With the *Max./Min.* display mode the measurement curve is only changed if the current measurement result exceeds all previous results.

Additional Information...

... on Step 4

① **Softkeys and hotkeys**

The functionality of each softkey on the right side is extended by hotkeys assigned to the softkeys. These hotkeys are displayed across the hotkey bar below the diagram when the softkey is selected.

Some of the softkey/hotkey combinations offer settings that can be also accessed via configuration menus. For example, the settings offered by the *Analyzer Level* softkey are also provided in the *Analyzer* tab of the *Connection Control* menu. Identical settings overwrite each other; the last value entered is valid for the whole function group.

The names of the softkeys and hotkeys and their function are standardized as much as possible; see the list on the right side.

② **Markers**

Markers are a graphical tool used to locate points on a measurement curve and read out their coordinates. A reference marker and two delta markers may be defined in the *Modulation* menu.

The reference marker R measures the absolute level of the measurement curve, the delta markers 1 and 2 measure the distance between their position and the reference marker.

... on Step 5

③ **Display Mode**

If the measurement extends over several slots the CMU calculates three different measurement curves one of which can be selected in the *Display Mode* panel. The purpose of the four measurement curves is to give an overview of the range and arithmetic mean value of the levels detected at any point on the time axis. In the *EVM QPSK* application the following measurement curves can be displayed:

Current	Result in the current slot
Max./Min.	Maximum or minimum of the results of all slots measured, whichever has the larger absolute value
Average	Average of the results referenced to the last statistics cycle

The *Statistic Count* input field defines how many evaluation periods form a statistics cycle. The evaluation period for Modulation measurements is equal to the measurement length set by means of the *Display/Marker – Meas. Length* hotkey.

Alternative Settings and Measurements

☞ Chapter 4.

The *Application* softkey switches between the different applications of a measurement.

The *Analyzer Level* softkey controls the level in the input signal path and provides the trigger settings.

The *Analyzer Settings* softkey determines the frequency of the analyzed RF signal.

The *Menus* softkey provides the hotkeys to switch over to other measurement menus.

☞ Chapter 4.

In addition to markers, a D-line can be used to measure a particular value in the diagram.

☞ Chapter 3.

To refine the statistical evaluation, a suitable combination of the statistic count, repetition mode, stop condition and display mode should be selected.

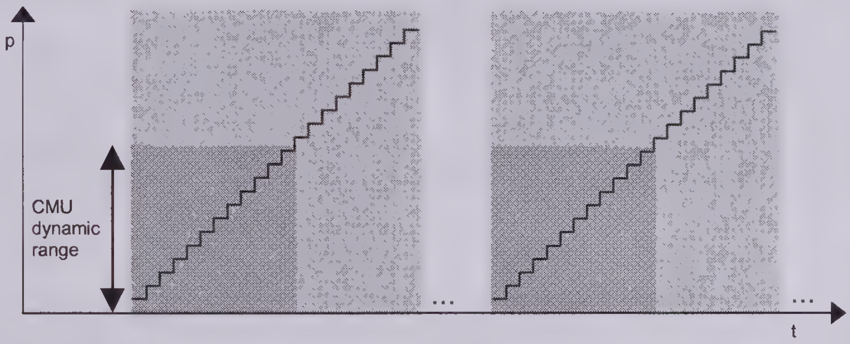
The operating principle of the other TX measurements *(Spectrum, Code Domain Power)* is analogous to the *Power* and *Modulation* measurements. For detailed information on all functions refer to Chapter 4 of this manual.

Application Example for P/Slot Table

P/Slot Table is a real-time measurement that was primarily designed for quick evaluation of power steps of the UE transmitter over a wide dynamic range. The measurement can even be extended beyond the dynamic range of the CMU provided that the UE signal is repeated. The following example also illustrates which steps are required to carry out a general *P/Slot Table* measurement and how the test settings are adapted to a typical power step measurement.

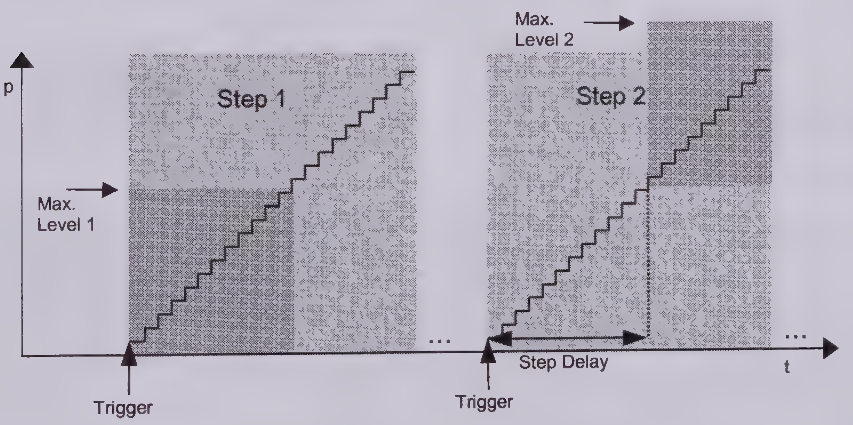
Measurement task

A WCDMA UE periodically transmits a series of regular power steps, i.e. its output power changes after every nth slot by a certain amount. The power ramp exceeds the dynamic range of the CMU. Nevertheless the CMU shall evaluate the entire power ramp as quickly as possible.



Solution

The CMU performs 2 subsequent single shot measurements. The *Max. Level* and the trigger delay parameters are changed between the 1st and the 2nd measurement.



Procedure

General configuration of the UE and the CMU:

1. Switch on the UE transmitter and provide a trigger signal that is synchronized with the beginning of the UE power ramp. Note the conditions for the external trigger signal described in section *Trigger (Connection Control – Trigger)* on p. 6.136 ff.
2. Apply the trigger signal at pin no. 8 of the AUX3 connector.
3. In the *Power* menu, press the *Analyzer Level – Trigger Source* softkey to select *External* trigger. If necessary, use the *Slot Delay* and *Delay Offset* parameters in the *Analyzer* tab of the *Connection Control* menu and correct the trigger time to exactly match the beginning of the power ramp.
4. Press *Analyzer Settings – RF Channel* to adapt the analyzer frequency to the frequency of the input signal.
5. Select the *P/Slot Table* application *(Application – P/Slot Table).*

6. Press *P/Slot Table – Step Width* to adapt the step width of the measurement to the step width (n) of the power ramp.

CMU configuration for step 1:

7. Press *Analyzer Level – Max. Level* to set the input level to Max. Level 1 (see figure above).

The CMU measures all power steps up to its *Max. Level.* Beyond the maximum level the output table shows invalid results (the table entries are "–"). The invalid results can be eliminated by reducing the number of measured values *(P/Slot Table – Step Count)*. For values that are not measured, the table indicates *Off.*

CMU configuration for step 2:

8. Press *Analyzer Level – Max. Level* to set the input level to Max. Level 2 (see figure above).
9. Set *Analyzer Level – Step Delay* equal to the number of steps measured before.

The measurement is now delayed by the measurement time of step 1. The CMU measures all power steps between Max. Level 1 and Max. Level 2. If necessary the reset of *Max. Level* and *Step Delay* can be repeated several times.

CMU and UE Configuration for Receiver Quality Tests

Performing a *Receiver Quality* test involves 4 steps:

1. The CMU generator (option CMU-K66) provides a WCDMA DL signal to which the UE can synchronize.
2. The UE receives the DL signal and loops back the received data on a specific UL channel.
3. The CMU receives the UL signal from the UE.
4. The CMU calculates the BER test results

The measurement can fail especially if the settings in steps 1 to 3 are incompatible. The following tables describe a sample test session and can serve as a checklist for the configuration of the CMU and the UE in *Non Signalling* mode.

Note: Receiver Quality *measurements are largely simplified if performed in* Signalling *mode; see Table 4-19 on p. 4.141.*

1. CMU Generator Settings

The DL generator signal is configured in the *Generator* tab of the *Connection Control* menu (see section *Generator Settings (Connection Control – Generator)* on p. 6.109 ff.).

Signal ON

- ➢ Press the *Connect. Control* softkey and the *Generator* hotkey to open the configuration menu for the RF generator. If necessary, press *Generator* again to access the softkey-oriented version of the *Generator* tab.
- ➢ Select the *Generator* softkey and press the *ON/OFF* key to switch the RF generator on.

The default generator signal levels are appropriate for *Receiver Quality* tests.

DL channel type

- ➢ Press the *Generator* hotkey to open the table-oriented version of the tab. Make sure that the generator provides a 3GPP reference measurement channel: The *Dedicated Channel Mode* must be set to *3GPP Reference.*

The *Receiver Quality* measurement can be performed with any data rate *(Reference Channel Type)* and any pseudo random bit sequence *(Channel Data Source DTCH)* provided:

- ➢ Select the 12.2 kbps *Reference Channel Type* and a PRBS9 *Channel Data Source DTCH.*

2. UE Configuration

UE receiver settings

- ➢ Make sure that the UE receiver frequency and the expected scrambling codes are compatible with the configuration of the DL generator signal.

By default the generator signal is at a frequency of 2112.4 MHz. The primary and secondary scrambling code numbers are both 0. The settings can be changed in the *Generator* tab of the *Connection Control* menu.

Close test loop

- ➢ Close the test loop at the UE.

For all *Receiver Quality* measurements the UE must be set to operate in test loop 2 mode where it effectively loops back the received transport block data and CRC bits.

Channel symmetry

- ➢ Configure the UE transmitter to generate a modified 12.2 kbps reference measurement channel with a transport block size of 260 bit, disabled UL CRC and a TFCI of 1 or 3 (indicating a non-empty DTCH).

Depending on the required measurement results (and on the capacity of the UE), it is possible to select either symmetric or asymmetric DL/UL transport block size. In the symmetric case the DL and UL *Reference Channel Type* must be the same. In the asymmetric case the DL and UL *Reference Channel Type* must still match although the UL channel represents a modified reference measurement channel with extended transport block size.

Output power

- ➢ Select an appropriate UE transmitter output power.

The UE transmitter output power must be adapted in order to exclude bit errors on the uplink as far as possible. Standard TS 34.121 specifies the uplink TX power for many test cases including BER tests.

Table 2-1 Transport block size and CRC bits for different RMC types

Reference Channel Type	Transport Block Size	Size of CRC
12.2 kbit/s, symmetric UL/DL **12.2 kbit/s, asymmetric UL/DL**	244 bit 260 bit	16 bit 0 bit
64 kbit/s, symmetric UL/DL **64 kbit/s, asymmetric UL/DL**	1280 bit 1296 bit	16 bit 0 bit
144 kbit/s, symmetric UL/DL **144 kbit/s, asymmetric UL/DL**	2880 bit 2896 bit	16 bit 0 bit
384 kbit/s, symmetric UL/DL **384 kbit/s, asymmetric UL/DL**	3840 bit 3856 bit	16 bit 0 bit

3. CMU Analyzer Settings

In order to receive the UL signal correctly, the settings in the *Receiver Quality* menu must match the configuration of the UE:

Scrambling code

- ➢ Press the *UE Code/Analyzer Settings* softkey to set the UL *Scrambling Code* used by the UE.

RF frequency

- ➢ Press *UE Code/Analyzer Settings – RF Channel* to set the analyzer frequency equal to the frequency of the UL signal.

Symmetry

- ➢ Press the *BER* measurement control softkey to select asymmetric UL/DL *Transport Block Size*.

The CMU analyzer is automatically adapted to the actual transport block size (260 bit for the 12.2 kbps reference measurement channel, see *Table 2-1 above*) as soon as symmetric or asymmetric UL/DL *Transport Block Size* is selected.

DL/UL timing

The CMU expects the looped-back UL signal to be transmitted 1024 chips in offset from the DL signal. A modification of the expected DL/UL timing can be necessary to compensate for a path delay or a deviation of the UE from the nominal timing.

- ➢ If the CMU issues the warning message *RX not synchronized,* press the *BER – DL/UL Timing* hotkey to adjust the DL/UL timing offset.

4. Start BER measurement

The *Receiver Quality* measurement can be started and stopped using the *BER* measurement control softkey.

- ➢ Press *BER* and use the *ON/OFF* key to start and stop a continuous measurement. To stop the measurement after one cycle and read the results, use the *CONT/HLT* key.

Results In the output fields on the left side of the *Receiver Quality* menu the CMU displays the measured BER, DBLER and BLER.

WCDMA Signalling

A typical *WCDMA UE Signalling* measurement session (with Option R&S CMU-K67/-K68/-K69) consists of the following stages:

1. Selection of the RF connectors; configuration of the RF input path
2. Connection of the UE to the CMU
3. Setup of a radio connection between the CMU and the UE under test, where the CMU mimics a UTRAN cell.
4. Selection of a measurement menu, start of the measurement and evaluation of the results

Steps 2 and 4 can be carried out in close analogy to *Non Signalling* measurements; for detailed examples see the previous section and the reference description in Chapter 4. The following operating sequence shows you how to set up a measurement in *Signalling* mode.

Preconditions

For the following we assume that options R&S CMU-K65/-K66 and one of the options R&S CMU-K67/-K68/-K69 (corresponding to the Operating Band of your UE) are properly installed on your Universal Radio Communication Tester R&S CMU 200 and that the instrument is correctly set up and connected to the AC power supply as described in Chapter 1 of the CMU200/300 operating manual.

1. To configure the RF path...

1. Switch on the instrument to initiate the startup process and access the *Menu Select* menu (see section *Preparing a WCDMA UE TX Test* on p. 2.2 ff.).
2. Select *WCDMA FDD – Signalling* and your preferred measurement application.

The menu opened depends on the last measurement session.

3. If the *Connection Control* menu is not opened automatically, press the *Connect. Control* softkey on top of the right softkey bar. Press the *RF* ⊖→ hotkey.
4. Ensure that RF 2 is selected as *RF Input* and *RF Output*.
5. Press the 1 / 2 and the *Analyzer* hotkey and check the analyzer level *Mode*.

Note: *The default analyzer level mode is* Auto. *In this mode the CMU automatically adjusts its input path to the received signal level. If needed you can select a* Manual Level *appropriate for your UE, depending on the* Expected PRACH Power *and* UE Target Power *(see* Connection *tab of the* Connection Control *menu).*

6. Press the 1 / 2 and the *Connection* hotkey. Press the *Band Select* softkey and select the Operating Band of your UE. If the title bar of the *Connection* tab does not show *Signal Off,* press the *Signal Off* softkey.

2. To connect your UE...

1. Use a coax cable to connect your UE to the *RF 2* front panel output connector (see section *Preparing a WCDMA UE TX Test* on p. 2.2 ff.).
2. Make sure that the UE is supplied with the correct operating voltage and switched on.

3. To set up a radio connection...

1. In the *Connection (Signal Off)* menu, press the *Signal On* softkey to switch on the WCDMA signal for synchronization.

The CMU enters the *Signal On* state. Your UE is now able to synchronize to the WCDMA signal of the CMU and to initiate a registration/location update procedure. The CMU reaches the *Registered* state.

2. In the *Connection (Registered)* menu, press the *Connect UE* softkey.

The CMU enters the *Alerting* state as the UE starts ringing.

3. Accept the connection at the UE.

The CMU enters the *Connected* state and automatically closes the *Connection Control* menu. In this state a dedicated channel (a Signalling Radio Access Bearer) is allocated between the CMU/UTRAN and the UE and TX measurements can be performed.

4. To start a measurement...

In the *Connected* state a dedicated channel between the CMU/UTRAN and the UE is established and TX measurements can be performed in analogy to the *Non Signalling* mode. Refer to the examples in the previous sections.

Failed Registration?

If registration fails, check the following items:

- The UE capabilities must be in accordance with the *Requested UE Data* settings in the *Network* tab of the *Connection Control* menu, in particular with the authentication and security mode. Registration can fail if authentication or security is disabled but the UE expects/requires an authentication or security procedure. It can also fail if authentication or security is enabled but not supported by the UE.
- The test USIM used must be in accordance with the relevant specifications (3GPP TS 31.101, 3GPP TS 31.102). An appropriate 3GPP UICC/USIM can be obtained from Rohde & Schwarz (R&S CRT-Z3, stock no. 1139.1005.02).

Accelerating the Connection

The CMU provides several parameters to define how a connection is set up and to force the UE under test to a definite operating mode. The following settings will minimize the time required to establish a connection:

Skip Alerting

In the default configuration, the CMU uses a Signalling Radio Access Bearer (SRAB) to set up and maintain a connection. Each call must be accepted at the UE before the CMU can enter the *Connected* state.

The CMU provides an alternative connection scheme where the dedicated channel is a configurable 3GPP Reference Measurement Channel (RMC) and the UE under test is forced into its test mode or into a test loop mode. In this scheme the *Alerting* state is skipped so there is no need to accept the call.

To force the DUT into its test loop mode 2...

1. Proceed as described in the previous section, to configure the RF path and establish a physical connection to the DUT.
2. In the *WCDMA 1900 FDD – Signalling* function group open the *Connection Control* menu. If the title bar of the *Connection* tab does not show *Signal Off,* press the *Signal Off* softkey.
3. Press the *Dedicated Channel* softkey and select *RMC.*
4. Open the *BS Signal* tab and select *RMC Settings – Test Mode = Loop Mode 2.*
5. Return to the *Connection (Signal Off)* tab and press the *Signal On* softkey to switch on the WCDMA signal for synchronization.

The CMU enters the *Signal On* state. Your UE is now able to synchronize to the WCDMA signal of the CMU and to initiate a registration/location update procedure. The CMU reaches the *Registered* state.

6. In the *Connection (Registered)* menu, press the *Connect UE* softkey.

The CMU directly enters the *Connected* state and automatically closes the *Connection Control* menu. In this state a Reference Measurement Channel is allocated between the CMU/UTRAN and the UE and the UE is in its test loop mode 2.

This configuration is suitable for **RX and TX** measurements.

Minimize requested UE data

In the default configuration, the CMU requests the UE to transfer its UE Radio Access Capability information. This data transfer slows down the registration process.

If there is no need to check the UE data, open the *Network* tab of *the Connection Control* menu and disable the request of UE data *(Requested UE Data – UE Radio Access Capability = Off).*

Avoid multiple registrations

Changing the cell-specific parameters (e.g. the network parameters MCC, MNC...) with registered UE causes a delay because the UE must repeat the registration procedure. To obtain maximum measurement speed, it is recommended to set all cell-specific parameters while the CMU is in the Signal Off state.

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3 Manual Control

This chapter gives a brief survey of the operating concept and structure of the user interface for WCDMA UE tests. The CMU was designed for maximum operating convenience and flexibility. All instrument functions are grouped together in menus; each of them provides a number of related configuration settings or displays a group of measured quantities. All menus show a similar structure so that many settings, once defined, can be used in several menu groups. Switchover between the different menu groups is possible at any time.

In the following, the different measurement modes and measured quantities are discussed. Settings and measurement parameters frequently encountered are explained from a general point of view.

The formal aspects of measurement control are discussed in more detail in chapter 5 *(Remote Control – Basics)* and in chapter 5 of the CMU200/300 operating manual.

Menu Structure

The menus used to control WCDMA UE measurements can be arranged in different ways. From a functional point of view, they form the following groups:

- The two test modes *Signalling* and *Non Signalling*
- General configurations *(Connection Control),*
- Measurement groups *(Power, Modulation, Spectrum, Code Domain Power, Receiver Quality)* and configurations specific to these measurement groups *(Power Configuration, Modulation Configuration, Spectrum Configuration, Code Domain Power Configuration, Receiver Quality Configuration).*

In a formal sense, the CMU uses main menus, popup menus, graphical measurement menus and dialog windows of various size. This aspect is discussed in chapter 3 of the operating manual for the CMU basic unit.

Test Mode

WCDMA UE measurements are performed in one of the two modes *Signalling* or *Non Signalling*. The *Non Signalling* mode is typically used for module tests or test of UEs in a special "test mode". The *Signalling* mode serves to measure the UE performance under realistic operating conditions where the CMU mimics an UTRAN cell.

Definition	The term signalling denotes all actions that are necessary to establish, control and terminate a communication between the Node B (CMU) and the UE. The signalling messages conveyed allow the UE and the network to discuss the management of issues either related to the user or concerning technical aspects of the communication.
Non Signalling TX Test Mode	In *Non Signalling* mode, the CMU analyzes the channel coded and modulated uplink WCDMA signal transmitted by the device under test. To conform to 3GPP WCDMA specifications, this signal must have definite properties with respect to its power, modulation, frequency, spectrum and code domain power. No signalling parameters are transferred, and no call connection is set up, so that test times are reduced considerably. The test signal may be inside or outside the designated WCDMA channel range. The TX tests provided in this test mode are listed in section *Measurement Groups* on p. 3.4 f.

Non Signalling Synchronized Mode

With option CMU-K66, *WCMDA (3GPP/FDD, DL) Generator*, the CMU can generate a WCDMA downlink signal to which the UE can synchronize. The generator signal can be used to transfer data to the UE, e.g. a Transmit Power Control (TCP) command pattern that instructs the UE to perform power steps.

If option CMU-B68/CMU-U68, *Layer 1 Board for WCDMA,* is fitted in addition, the CMU is able to perform *Receiver Quality* tests based on a comparison of the data transferred to the UE and the data looped back.

All TX and RX tests are listed in section *Measurement Groups* on p. 3.4 f.

Signalling Mode

In *Signalling* mode, the CMU transmits a downlink WCDMA signal *(BS Signal)* to which the mobile phone can synchronize. When it receives this signal, the UE can initiate a registration to the UTRAN/CMU, after which a connection may be set up from either side.

The CMU is able to configure a broad range of network parameters, to vary the settings for the different channels in its WCDMA downlink signal, and to check parameters like the UE radio access capability.

All TX and RX tests provided in this test mode are listed in section *Measurement Groups* on p. 3.4 f.

Symbols for Signalling Mode and State

The *test mode* and *state*is indicated to the left of the operating mode in each main menu and graphical measurement menu (see chapter 3 of CMU200/300 operating manual). The following symbols occur the WCDMA UE function groups:

Non signalling mode, TX tests

Signalling mode, Signal Off

Signalling mode, Signal On (icon blinks)

Signalling mode, Registered

Signalling mode, Alerting

Signalling mode, Connected

Configurations

The CMU offers a wide range of settings for the RF signal generators and analyzers, the signal inputs and outputs signalling procedures, reference frequency, RF input path, trigger, and the individual measurements. Configurations may apply to the whole function group *(Connection Control, signalling parameters)* or to a particular measurement.

Connection Control

The *Connect. Control* softkey is located to the right of the title bar in each measurement menu. It opens a popup menu with several tabs controlling

- The RF analyzer settings *(Analyzer* in Non Signalling, *UE Signal* in Signalling mode) and the properties of the WCDMA signal from the UE that can be analyzed *(UE Code)*
- The properties of the RF generator signal *(Generator/BS Signal*, with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator* only)
- The RF connectors to be used and the external attenuation *(RF Input/Output)*
- The reference signal and the system clock *(Sync.)*
- The trigger settings *(Trigger)*
- The routing of the I/Q and IF signals *(I/Q-IF,* with option CMU-B17 only)
- In *Signalling* mode (with option CMU-K67/-K68/-K69), all actions changing the CMU's signalling state *(Connection)*
- In *Signalling* mode, parameters of the network and the mobile station under test *(Network)*
- In *Signalling* mode, parameters to control the display *(Misc.)*

All settings made in the *Connect. Control* menu are valid for the whole function group. Many of them can be accessed and overwritten, however, by means of the softkeys and hotkeys offered in the measurement menus.

Configuration of measurements

A popup menu offering specific settings is assigned to each measurement group *(Power, Modulation, Spectrum, Code Domain Power, Receiver Quality)*. The following general parameters can be defined in separate tabs:

- The repetition mode, stop condition, statistic count and display mode for the measurement *(Control)*
- Tolerances for the measured quantities *(Limits, Limit Lines)*

These settings are explained in more detail below (see section *General Settings* on page 3.5). For measurement-specific settings provided in the measurement configuration menus refer to Chapter 4.

Configuration via hotkeys

The softkeys and associated hotkeys in the measurement menus provide the most important configurations for the current measurement; see chapter 4 and chapter 3 of the CMU200/300 operating manual. Settings may via hotkeys supersede the corresponding settings made in the configuration menus.

Measurement Groups

Measurement results are indicated in two different ways:

- Discrete values and parameters are displayed in output fields, lists and tables. In remote control, these results are referred to as scalars.
- Traces are displayed in a Cartesian coordinate system, the time or frequency forming the x-axis scale. Relatively small sets of test points are generally viewed in a bar graph. In remote control, results of this type are referred to as arrays.

While the measurement is running in repetition mode *Continuous* (see page 3.5), the results are constantly updated. An overview of the measurements is given in the table below.

Table 3-1 Measurement groups in *Signalling* and *Non Signalling* mode

Non Signalling	**Signalling**
Power Application *Max. Power/Min. Power/Off Power* Measurement of the peak and RMS-averaged transmitter output power in different operating modes of the WCDMA UE. Application *Inner Loop TPC:* Test of the inner loop Transmit Power Control (TPC). Application *P/Slot Table* quick evaluation of power steps of the UE transmitter over a wide dynamic range. A statistical evaluation and a limit check is performed for the measured quantities (exception: *P/Slot Table).*	**Power** Application *Max. Power/Min. Power/Off Power* Measurement of the peak and RMS-averaged transmitter output power in different operating modes of the WCDMA UE. Application *Inner Loop TPC:* Test of the inner loop Transmit Power Control (TPC). A statistical evaluation and a limit check is performed for the measured quantities.
Modulation Measurement of the error vector magnitude, magnitude error or phase error derived from the modulation vector as a function of time. Scalar modulation quantities such as the frequency error, average and RMS phase error, I/Q imbalance, I/Q origin offset, waveform quality, as well as statistical results (peak and RMS values) and the results of the limit check are indicated in addition. Single QPSK modulated signals or 3GPP standard uplink WCDMA signals with a chip rate of 3.84 Mcps and channel coding can be analyzed. For the latter, the peak code domain error is also available. Application *Overview QPSK/WCDMA* Table showing a statistical evaluation of modulation parameters for QPSK and WCDMA signals. Application *EVM QPSK/WCDMA* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of the modulation parameters. Application *Magn. Error QPSK/WCDMA* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of the modulation parameters. Application *Phase Error QPSK/WCDMA* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of the modulation parameters. A statistical evaluation and a limit check is performed for the measured quantities (exception: *P/Slot Table).*	**Modulation** Measurement of the error vector magnitude, magnitude error or phase error derived from the modulation vector as a function of time. Scalar modulation quantities such as the frequency error, average and RMS phase error, I/Q imbalance, I/Q origin offset, waveform quality, as well as statistical results (peak and RMS values) and the results of the limit check are indicated in addition. Single QPSK modulated signals or 3GPP standard uplink WCDMA signals with a chip rate of 3.84 Mcps and channel coding can be analyzed. For the latter, the peak code domain error is also available. Application *Overview QPSK/WCDMA* Table showing a statistical evaluation of modulation parameters for QPSK and WCDMA signals. Application *EVM QPSK/WCDMA* Diagram showing the error vector magnitude (EVM) within the burst as a function of time plus a statistical evaluation of the modulation parameters. Application *Magn. Error QPSK/WCDMA* Diagram showing the magnitude error within the burst as a function of time plus a statistical evaluation of the modulation parameters. Application *Phase Error QPSK/WCDMA* Diagram showing the phase error within the burst as a function of time plus a statistical evaluation of the modulation parameters. A statistical evaluation and a limit check is performed for the measured quantities (exception: *P/Slot Table).*

Application *I/Q analyzer QPSK/WCDMA* Analysis of the UE signal in the I/Q plane: Constellation diagram, vector diagram and eye pattern.	
Spectrum Measurement of the adjacent channel leakage power ratio (ACLR) at definite off-carrier frequencies (application *ACLR Filter)*, or as a continuous function of the frequency (application *ACLR FFT/OBW)*. From the measurement curve in the ACLR FFT/OBW application, the occupied bandwidth (OBW) is derived. The off-carrier power can be measured with different filter characteristics to obtain the spectrum emissions. Statistical evaluations and a limit check are performed in addition.	**Spectrum** Measurement of the adjacent channel leakage power ratio (ACLR) at definite off-carrier frequencies (application *ACLR Filter)*, or as a continuous function of the frequency (application *ACLR FFT/OBW)*. From the measurement curve in the ACLR FFT/OBW application, the occupied bandwidth (OBW) is derived. The off-carrier power can be measured with different filter characteristics to obtain the spectrum emissions. Statistical evaluations and a limit check are performed in addition.
Code Domain Power Measurement of the code domain power or of the rho factor in the code domain channels (*DCP/Code Auto* or *DCP/Code Rho Auto* representation) or in the physical channels (*DCP/Code Manual* or *DCP/Code Rho Manual* representation). Statistical evaluations and a limit check are provided in addition.	**Code Domain Power** Measurement of the code domain power or of the rho factor in the code domain channels (*DCP/Code Auto* or *DCP/Code Rho Auto* representation) or in the physical channels (*DCP/Code Manual* or *DCP/Code Rho Manual* representation). Statistical evaluations and a limit check are provided in addition.
Receiver Quality Measurement of quantities assessing the quality and performance of the UE receiver (Bit Error Rate, Block Error Rate, Data Block Error Rate) in synchronized mode, where the CMU provides a data stream transferred on the DL channel and the UE loops back the received data in different transport block formats. Statistical evaluations and a limit check are provided in addition.	**Receiver Quality** Measurement of quantities assessing the quality and performance of the UE receiver (Bit Error Rate, Block Error Rate, Data Block Error Rate) in synchronized mode, where the CMU provides a data stream transferred on the DL channel and the UE loops back the received data in different transport block formats. Statistical evaluations and a limit check are provided in addition.

A graphical overview of the menus is given at the end of this chapter.

General Settings

A number of settings can be made in several of the configuration menus assigned to the measurement groups. In combination, these settings define the scope of the measurement, i.e. the number of slots/evaluation periods measured and the results displayed. The following brief overview is intended to avoid confusion of terms.

Application

Applications are different measurements belonging to the same measurement group. They effectively split up a measurement group into various related subgroups which can be configured separately.

They are selected via the *Application* softkey in the measurement menus.

Statistic Count

The term *statistic count* denotes the integer number of slots/evaluation periods which form one measurement cycle. Together with the *repetition mode* and the *stop condition,* the statistic count determines when exactly the measurement is stopped.

The *statistic count* is set in the *Control* tab of the configuration popup-menus assigned to the four measurement groups *Power, Modulation*, *Spectrum,* and *Code Domain Power.*

Repetition Mode

The *repetition mode* defines when a measurement that is not stopped by a limit failure (see stop condition *On Limit Failure* below) will be terminated. Two modes are available for all measurements:

Single Shot	The measurement is stopped after one *statistic count*.
Continuous	The measurement is continued until explicitly terminated by the user; the results are periodically updated.

A third repetition mode is available with remote control:

Counting	Repeated single shot measurement with a fixed number of statistic counts. The calculation of average, minimum and maximum curves (see *Display Mode* below) starts again from the beginning after each measurement cycle.

The *repetition mode* is set in the *Control* tab of the configuration popup-menus assigned to the four measurement groups *Power*, *Modulation, Spectrum* and *Code Domain Power.*

Note: *In contrast to other measurement settings, thee repetition modes in manual and remote control are independent and do not overwrite each other. In most measurements, the default repetition mode in manual control is* Continuous *(observe results over an extended period of time), the default mode in remote control is* Single Shot *(perform one measurement and retrieve results).*

Stop Condition

A *stop condition* can be set for most measurements:

None	The measurement is performed according to its repetition mode, irrespective of the measurement results and the limits set.
On Limit Failure	The measurement is stopped as soon as one of the limits is exceeded, irrespective of the repetition mode set. If no limit failure occurs, it is performed according to its repetition mode.

The *stop condition* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups.

Display Mode

In graphical measurement diagrams, the *display mode* defines which of the measured and calculated curves is displayed if the measurement extends over several slots/evaluation periods. In general, curves are evaluated at a set of fixed, equidistant test points (samples). After n slots/evaluation periods, n measurement results per test point have been taken.

Current	The current slot, i.e. the last result for all test points, is displayed.
Minimum	At each test point, the minimum value of all slots/evaluation periods measured is displayed.
Maximum	At each test point, the maximum value of all slots/evaluation periods measured is displayed.
Max./Min.	At each test point, the extreme value of all slots/evaluation periods measured is displayed, i.e. the maximum or minimum, whichever has a larger absolute value.
Average	At each test point, a suitably defined average over all slots/evaluation periods measured is displayed; see section *Averaging and Statistical Evaluation below.*

The *display mode* is set in the *Control* tab of the configuration popup-menus assigned to the measurement groups *Modulation, Spectrum,* and *Code Domain Power.*

Averaging and Statistical Evaluation

In WCDMA transmitter tests, the test parameters are typically evaluated with a basic evaluation period (measurement length) corresponding to one transmit slot comprising 2560 chip periods or an integer fraction of it. Continuous measurements may extend over many consecutive slots/evaluation periods; the wealth of information obtained in such a measurement is further processed and output as average and statistical quantities.

Calculation of Average Values

Average values can be taken in two steps:

1. A test parameter is averaged over one slot (or an integer fraction of it termed the measurement length) to yield the *Current* result.
2. The *Current* result is averaged once again over several consecutive slots/evaluation periods to yield *Average* quantities.

The settings used to obtain the different types of results are explained in section *General Settings* on p. 3.5 (see display mode). The formulas applied for step 1 and 2 are described below.

Current results

Assume that a test parameter *Par* has been measured at N test points covering the whole measurement length (e.g. the slot). The RMS average of *Par* is defined by the following equation:

$$Par(RMS) = \sqrt{\frac{1}{N}\sum_{n=1}^{N} \left| Par(n) \right|^2} \qquad \text{(Equation 3-1).}$$

Equation 3-1 is used to average all power parameters, e.g. the UE Power (RMS) displayed in all measurement menus, and all quantities derived from power parameters, e.g. the ACLR provided in the *Spectrum* menu. It is also for the calculation of the Phase Error (RMS) in the *Modulation* menu. The values *EVM (RMS)* and *Magn. Error (RMS)* in the *Modulation* menu are obtained by dividing the RMS-averaged magnitude of the error vector and the RMS-averaged magnitude error by the magnitude of the RMS-averaged ideal modulation vector. All three quantities are RMS-averaged according to *Equation 3-1*.

Average results: measurement curves

The *Average* curves in the *Modulation* and *Spectrum* menus are obtained as follows:

Let c be the number of slots/evaluation periods forming one statistics cycle (one *statistic count)* and assume that n slots/evaluation periods have been measured since the start of the measurement. In calculating the *Average* curve, the following two situations are distinguished:

$n \leq c$ Single shot measurement or continuous measurement during the first statistics cycle: At each test point, *Average* curve no. n is calculated from *Average* curve no. n – 1 and *Current* curve no. n according to the following recurrence:

$$Avg(n) = \frac{n-1}{n} Avg(n-1) + \frac{1}{n} Curr(n) \quad (n = 1, \ldots, c) \quad \text{(Equation 3-2).}$$

The *Average* curve represents the arithmetic mean value over all n slots/evaluation periods measured.

$n > c$ Continuous measurement after the first statistics cycle: At each test point, *Average* curve no. n is calculated from *Average* curve no. n – 1 and *Current* curve no. n according to

$$Avg(n) = \frac{c-1}{c} Avg(n-1) + \frac{1}{c} Curr(n) \qquad (n > c) \qquad \text{(Equation 3-3).}$$

The formulas hold for n = 1 where the average curve becomes equal to the current curve (statistics off).

Average results: scalar values

Scalar quantities and the results displayed in bar graphs are generally averaged in analogy to Average curves using Equation 3-2 and Equation 3-3. Please note the following two exceptions:

For RMS-averaged Current values that were obtained by means of Equation 3-1, Equation 3-2 is replaced by an RMS-type averaging prescription:

$$Avg(n)_{RMS} = \sqrt{\frac{n-1}{n} \left| Avg(n-1)_{RMS} \right|^2 + \frac{1}{n} \left| Curr(n)_{RMS} \right|^2} \qquad (n = 1,\ldots,c) \qquad \text{(Equation 3-4).}$$

and an analogous formula with constant weighting factors (c – 1)/c, 1/c replaces Equation 3-3. Equation 3-4 is used to average the quantities Err. Vect. Magn. (RMS), Phase Error (RMS) and Magn. Error (RMS) in the Modulation menu over several slots/evaluation periods.

For Current values that are expressed in logarithmic units (dB or dBm), averaging is done before logarithmation so that Equation 3-2 is replaced by the following averaging prescription:

$$Avg(n)_{dB} = 10 \cdot \log\left(\frac{n-1}{n} 10^{Avg(n-1)_{dB}/10} + \frac{1}{n} 10^{Curr(n)_{dB}/10} \right) \qquad (n = 1,\ldots,c) \qquad \text{(Equation 3-5).}$$

and an analogous formula replaces Equation 3-3. Equation 3-5 is used to average the quantities Origin Offset, I/Q Imbalance and Peak Code Domain Error in the Modulation menu as well as the ACLR in the Spectrum menu and the Code Domain Power in the Code Domain Power measurement menu.

Calculation of Statistical Values

Besides the *Average* procedures described in the previous section, the CMU provides the statistics functions *Minimum, Maximum* and *Max./Min.* For a test parameter which is measured at N test points, the following definitions apply:

- The *Maximum* is the largest of the N measurement values.
- The *Minimum* is the smallest of the N measurement values.
- The *Max./Min.* value is either the *Maximum* or the *Minimum*, whichever has the larger absolute value. In other words, it is the *Maximum* of the absolute value times the sign of the test parameter at the maximum point. The *Max./Min.* function is applied to parameters with alternating sign that must be confined to a symmetric range centered around zero, e.g. the phase error of the modulation vector.

If a test parameter is measured over several slots/evaluation periods, the statistics functions can be combined in analogy to the different averages described in section *Calculation of Average Values above*:

1. The test parameter *Par* is averaged (either RMS-average or arithmetic mean value) or maximized over one slot (or an integer fraction of it termed the measurement length) to yield the *Current* results denoted *Par (Average), Par (RMS), Par (Peak).*
2. The *Current* results are once again averaged, maximized or minimized over several consecutive slots/evaluation periods to yield *Average, Maximum, Minimum, Max./Min.* results.

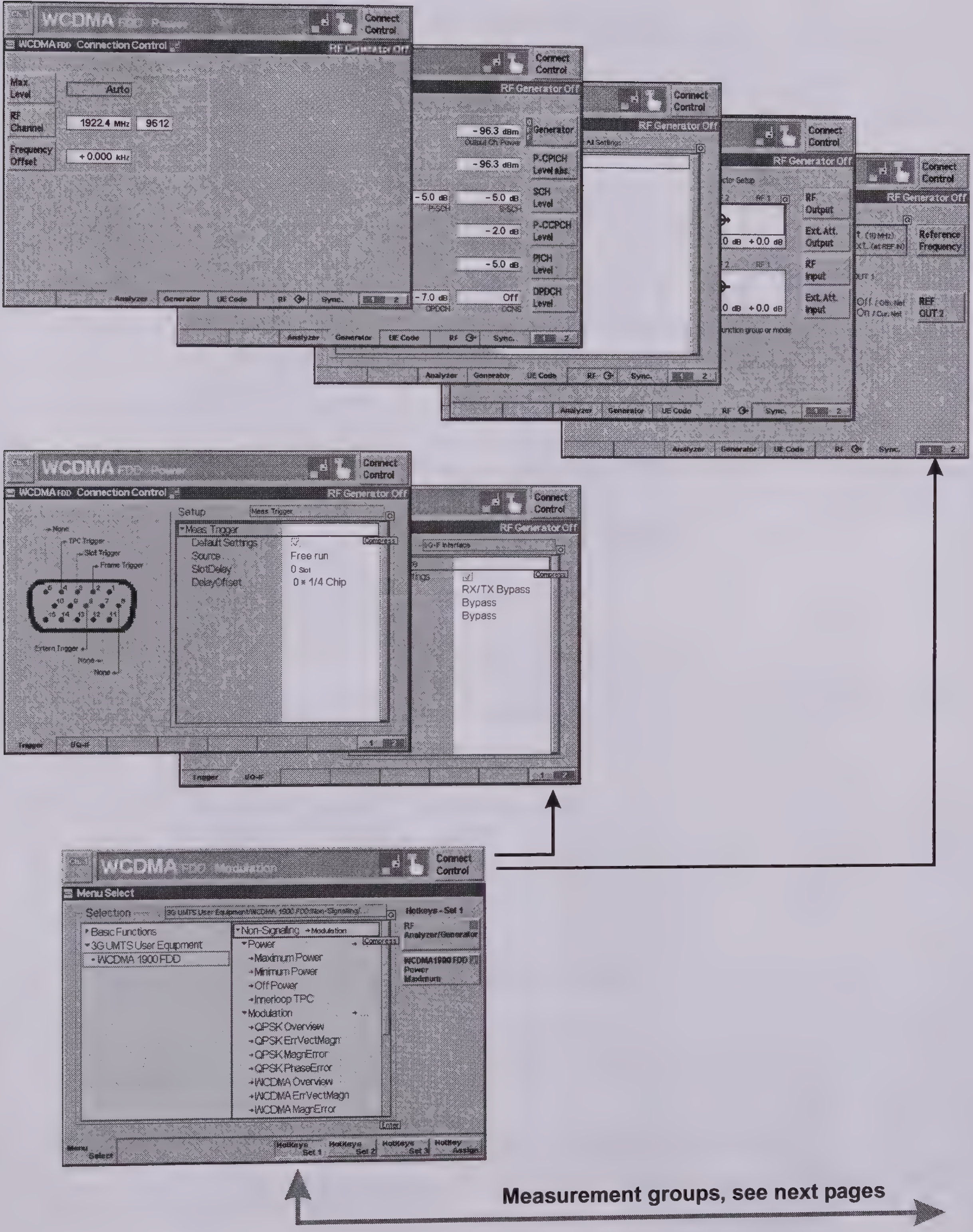
An overview of the statistical values determined in the WCDMA measurement menus together with the formulas used for averaging is given below.

Table 3-2 Statistical values in WCDMA measurements

Meas. menu	**Application**	**Slot with c test points**	**N consecutive slots**
Power	Maximum Power	UE Power (Peak): Current UE Power (RMS): Current (*Equation 3-1*)	UE Power (Peak): Average (*Equation 3-5*) UE Power (Peak): Maximum UE Power (RMS): Average (*Equation 3-5*) UE Power (RMS): Maximum UE Power (RMS): Minimum
	Minimum Power Off Power	UE Power (Peak): Current UE Power (RMS): Current (*Equation 3-1*)	UE Power (Peak): Average (*Equation 3-5*) UE Power (Peak): Maximum UE Power (RMS): Average (*Equation 3-5*) UE Power (RMS): Maximum
	P/Slot Table/ Inner Loop TPC	UE Power (RMS): Current (*Equation 3-1*)	No statistical evaluation
Modulation	Overview QPSK (each of the other QPSK applications offers a subset of the Overview QPSK parameters)	Err. Vect. Magn. (Peak): Current Err. Vect. Magn. (RMS): Current (*Equation 3-1*) Magn. Error (Peak): Current Magn. Error (RMS): Current (*Equation 3-1*) Phase Error (Peak): Current Phase Error (RMS): Current (*Equation 3-1*) I/Q Origin Offset: Current I/Q Imbalance: Current (*Equation 3-1*) Carrier Frequency Error: Current Waveform Quality: Current	Err. Vect. Magn. (Peak): Average (*Equation 3-4*) Err. Vect. Magn. (Peak): Max./Min. Err. Vect. Magn. (RMS): Average (*Equation 3-4*) Err. Vect. Magn. (RMS): Max./Min. Magn. Error (Peak): Average (*Equation 3-4*) Magn. Error (Peak): Max./Min. Magn. Error (RMS): Average (*Equation 3-4*) Magn. Error (RMS): Max./Min. Phase Error (Peak): Average (*Equation 3-4*) Phase Error (Peak): Max./Min. Phase Error (RMS): Average (*Equation 3-4*) Phase Error (RMS): Max./Min. I/Q Origin Offset: Average (*Equation 3-5*) I/Q Origin Offset: Max./Min. I/Q Imbalance: Average (*Equation 3-5*) I/Q Imbalance: Max./Min. Carrier Freq. Error: Average (*Equation 3-2*) Carrier Frequency Error: Max./Min. Waveform Quality: Average (*Equation 3-2*) Waveform Quality: Max./Min.
	Overview WCDMA (each of the other WCDMA applications offers a subset of the Overview QPSK parameters)	all parameters of the Overview QPSK application. In addition: Peak Code Dom. Error: Current Transmit Time Error: Current	Peak Code Dom. Error: Average (*Equation 3-5*) Peak Code Domain Error: Max./Min. Transmit Time Error: Average (*Equation 3-2*) Transmit Time Error: Max./Min.
Spectrum	ACLR Filter	ACLR (Peak): Current ACLR (RMS): Current (*Equation 3-1*)	ACLR (Peak): Maximum ACLR (RMS): Average (*Equation 3-5*) ACLR (RMS): Maximum
	ACLR FFT/OBW	ACLR (RMS): Current OBW: Current	ACLR (RMS): Average (*Equation 3-5*) ACLR (RMS): Maximum OBW: Average (*Equation 3-2*) OBW: Maximum
	Emission Mask	ACLR (RMS): Current	ACLR (RMS): Average (*Equation 3-5*) ACLR (RMS): Maximum
Code Domain Power	CDP/Code Manual (application CDP/Code Auto offers a subset of the parameters)	Code Domain Power (RMS): Current	Code Dom. P. (RMS): Average (*Equation 3-5*) Code Domain Power (RMS): Maximum Code Domain Power (RMS): Minimum
	CDP/Code Rho Manual (application CDP/Code Rho Auto offers a subset of the parameters)	CD-ρ (RMS): Current	CD-ρ (RMS): Average (*Equation 3-2*) CD-ρ (RMS): Maximum CD-ρ (RMS): Minimum

Menu Overview

Non Signalling: Connection Control



Max. Level: Auto

RF Channel: 1922.4 MHz 9612

Frequency Offset: +0.000 kHz

Generator: -96.3 dBm Output Ch. Power

P-CPICH Level abs.: -96.3 dBm

SCH Level: -5.0 dB P-SCH, -5.0 dB S-SCH

P-CCPCH Level: -2.0 dB

PICH Level: -5.0 dB

DPDCH Level: -7.0 dB DPDCH, Off OCNS

Ext. Att. Output: +0.0 dB +0.0 dB

Ext. Att. Input: +0.0 dB +0.0 dB

Setup: Meas Trigger

- Meas Trigger
  - Default Settings ☑
  - Source: Free run
  - SlotDelay: 0 Slot
  - DelayOffset: 0 * 1/4 Chip

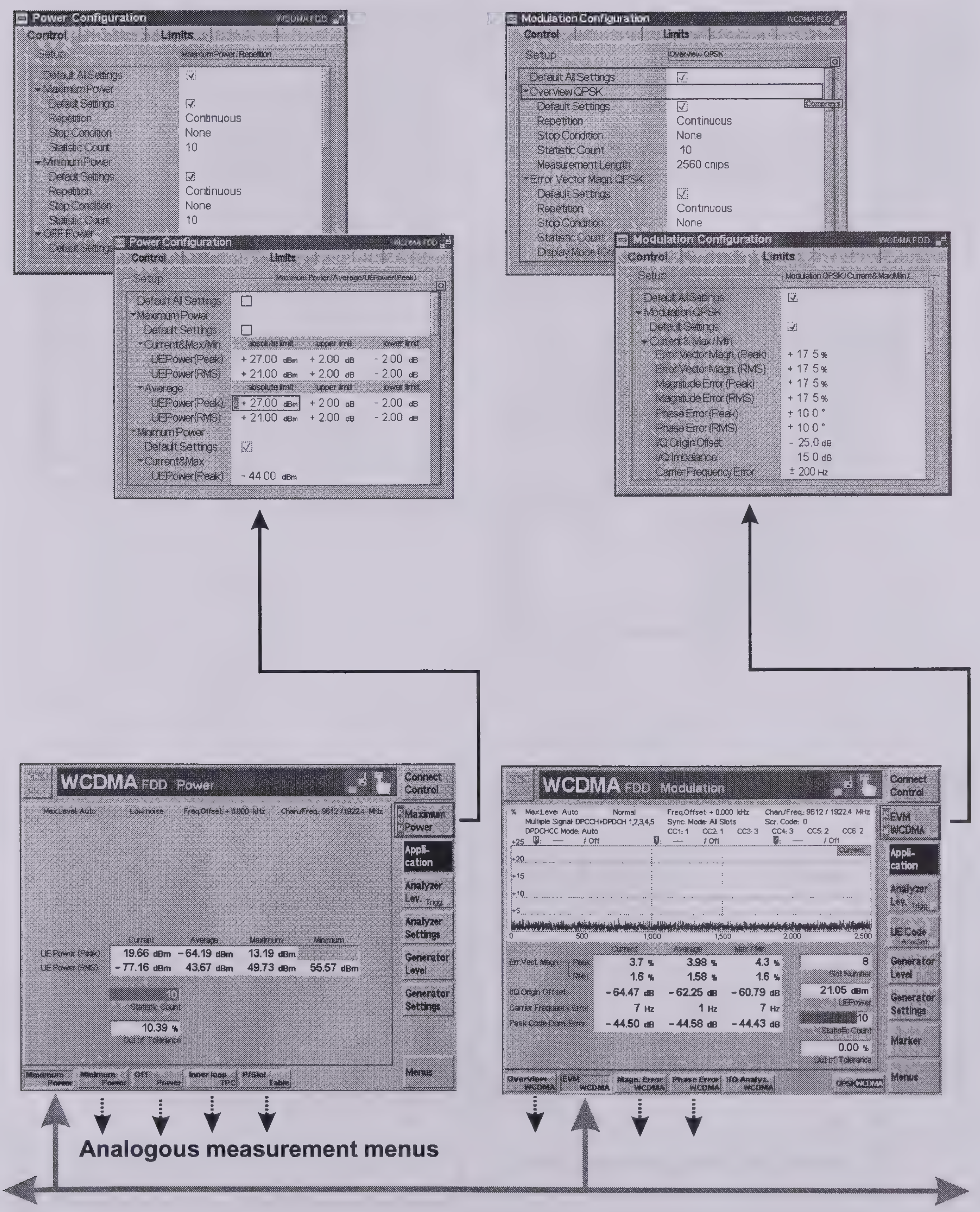
I/Q-IF Interface: RX/TX Bypass, Bypass, Bypass

Selection: 3G UMTS User Equipment/WCDMA 1900 FDD/Non-Signalling/

WCDMA FDD Power
Connect Control
WCDMA FDD Connection Control
RF Generator Off
Analyzer
Generator
UE Code
RF
Sync.
1 2
All Settings
Connector Setup
RF 2
RF 1
RF Output
RF Input
Reference Frequency
INT. (10 MHz)
EXT. (at REF IN)
REF OUT 1
Off / Oth. Net
On / Cur. Net
REF OUT 2
function group or mode
None
TPC Trigger
Slot Trigger
Frame Trigger
Extern Trigger
None
None
Compress
Trigger
I/Q-IF
WCDMA FDD Modulation
Menu Select
Basic Functions
3G UMTS User Equipment
WCDMA 1900 FDD
Non-Signalling → Modulation
Power
Maximum Power
Minimum Power
Off Power
Innerloop TPC
Modulation
QPSK Overview
QPSK ErrVectMagn
QPSK MagnError
QPSK PhaseError
WCDMA Overview
WCDMA ErrVectMagn
WCDMA MagnError
Enter
Hotkeys - Set 1
RF Analyzer/Generator
WCDMA1900 FDD Power Maximum
Menu Select
Hotkeys Set 1
Hotkeys Set 2
Hotkeys Set 3
Hotkey Assign

Measurement groups, see next pages

Power and Modulation


Power Configuration
WCDMA FDD
Control
Limits
Modulation Configuration
WCDMA FDD Power
WCDMA FDD Modulation
Connect Control
Maximum Power
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Menus
Maximum Power
Minimum Power
Off Power
Inner loop TPC
P/Slot Table
EVM WCDMA
UE Code Ana.Set.
Marker
Overview WCDMA
EVM WCDMA
Magn. Error WCDMA
Phase Error WCDMA
I/Q Analyz. WCDMA
QPSK WCDMA
Analogous measurement menus

Power Configuration – Setup: Maximum Power/Repetition

Default All Settings	☑
Maximum Power	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Minimum Power	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
OFF Power	
Default Settings	

Power Configuration – Setup: Maximum Power/Average/UEPower(Peak)

Default All Settings	☐		
Maximum Power			
Default Settings	☐		
Current&Max/Min	absolute limit	upper limit	lower limit
UEPower(Peak)	+ 27.00 dBm	+ 2.00 dB	- 2.00 dB
UEPower(RMS)	+ 21.00 dBm	+ 2.00 dB	- 2.00 dB
Average	absolute limit	upper limit	lower limit
UEPower(Peak)	+ 27.00 dBm	+ 2.00 dB	- 2.00 dB
UEPower(RMS)	+ 21.00 dBm	+ 2.00 dB	- 2.00 dB
Minimum Power			
Default Settings	☑		
Current&Max			
UEPower(Peak)	- 44.00 dBm		

Modulation Configuration – Setup: Overview QPSK

Default All Settings	☑
Overview QPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Measurement Length	2560 chips
Error Vector Magn QPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	
Display Mode (Gr	

Modulation Configuration – Setup: Modulation QPSK/Current&Max/Min/...

Default All Settings	☑
Modulation QPSK	
Default Settings	☑
Current & Max/Min	
Error Vector Magn. (Peak)	+ 17.5 %
Error Vector Magn. (RMS)	+ 17.5 %
Magnitude Error (Peak)	+ 17.5 %
Magnitude Error (RMS)	+ 17.5 %
Phase Error (Peak)	± 10.0 °
Phase Error (RMS)	+ 10.0 °
I/Q Origin Offset	- 25.0 dB
I/Q Imbalance	15.0 dB
Carrier Frequency Error	± 200 Hz

WCDMA FDD Power: Max.Level: Auto   Low noise   Freq.Offset: + 0.000 kHz   Chan/Freq.: 9612 / 1922.4 MHz

	Current	Average	Maximum	Minimum
UE Power (Peak)	19.66 dBm	- 64.19 dBm	13.19 dBm	
UE Power (RMS)	- 77.16 dBm	43.67 dBm	49.73 dBm	55.57 dBm

Statistic Count: 10

Out of Tolerance: 10.39 %

WCDMA FDD Modulation: Max.Level: Auto   Normal   Freq.Offset: + 0.000 kHz   Chan/Freq.: 9612 / 1922.4 MHz
Multiple Signal: DPCCH+DPDCH 1,2,3,4,5   Sync. Mode: All Slots   Scr. Code: 0
DPDCHCC Mode: Auto   CC1: 1   CC2: 1   CC3: 3   CC4: 3   CC5: 2   CC6: 2

	Current	Average	Max / Min
Err.Vect.Magn. Peak	3.7 %	3.98 %	4.3 %
Err.Vect.Magn. RMS	1.6 %	1.58 %	1.6 %
I/Q Origin Offset	- 64.47 dB	- 62.25 dB	- 60.79 dB
Carrier Frequency Error	7 Hz	1 Hz	7 Hz
Peak Code Dom. Error	- 44.50 dB	- 44.58 dB	- 44.43 dB

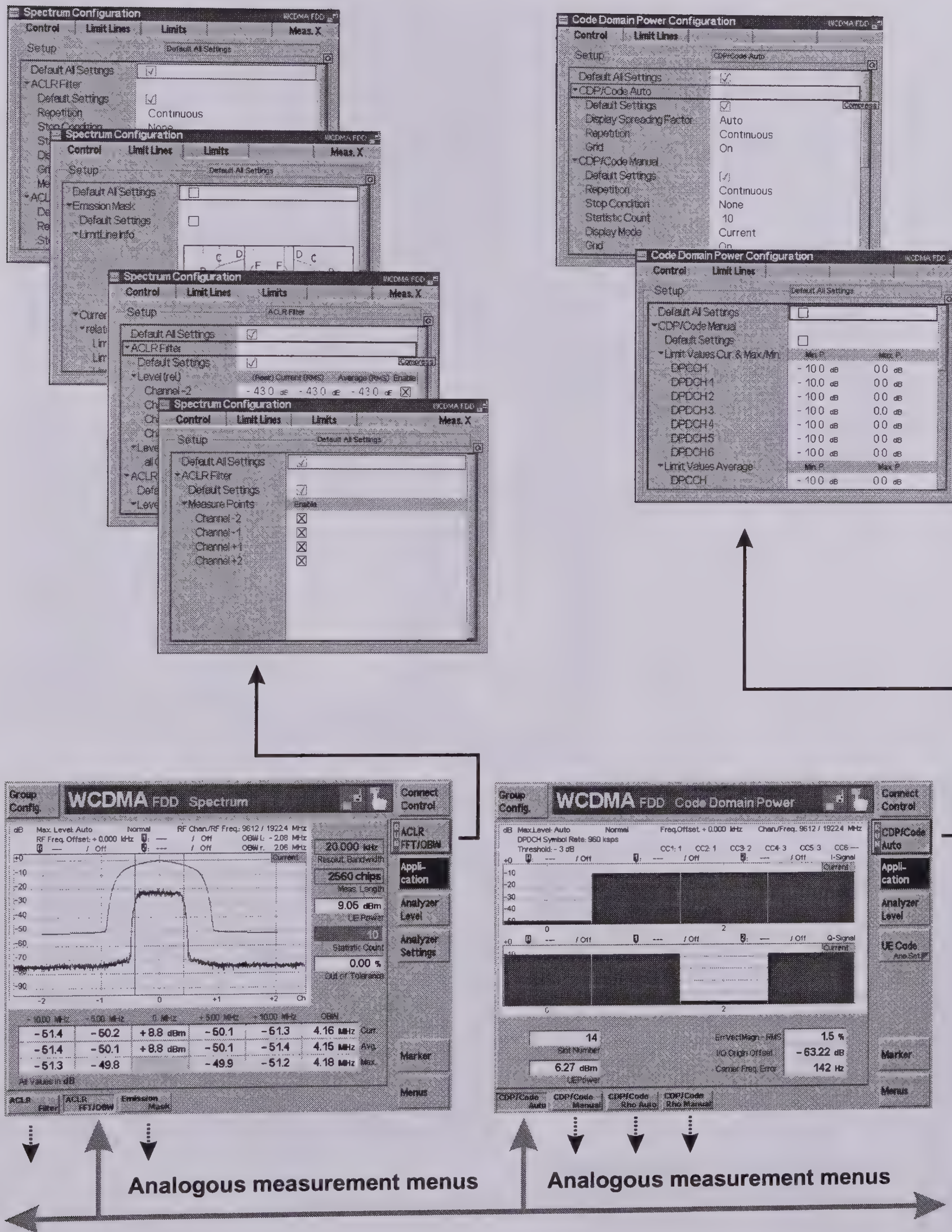
Slot Number: 8

UEPower: 21.05 dBm

Statistic Count: 10

Out of Tolerance: 0.00 %

Spectrum and Code Domain Power


Spectrum Configuration
WCDMA FDD
Control
Limit Lines
Limits
Meas. X
Setup
Default All Settings
ACLR Filter
Emission Mask
Compress
Code Domain Power Configuration
CDP/Code Auto
Group Config.
WCDMA FDD Spectrum
Connect Control
ACLR FFT/OBW
Application
Analyzer Level
Analyzer Settings
Marker
Menus
ACLR Filter
ACLR FFT/OBW
Emission Mask
WCDMA FDD Code Domain Power
CDP/Code Auto
UE Code Ana.Set.
CDP/Code Manual
CDP/Code Rho Auto
CDP/Code Rho Manual
Analogous measurement menus
Analogous measurement menus

Spectrum Configuration – Setup: Default All Settings

Default All Settings	☑
ACLR Filter	
Default Settings	☑
Repetition	Continuous
Stop Condition	None

Spectrum Configuration – Setup: Default All Settings

Default All Settings	☐
Emission Mask	
Default Settings	☐
LimitLine Info	

Spectrum Configuration – Setup: ACLR Filter

	(Peak) Current (RMS)	Average (RMS)		Enable
Default All Settings	☑			
ACLR Filter				
Default Settings	☑			
Level (rel)				
Channel -2	- 43.0 dB	- 43.0 dB	- 43.0 dB	☒

Spectrum Configuration – Setup: Default All Settings

	Enable
Default All Settings	☑
ACLR Filter	
Default Settings	☑
Measure Points	
Channel -2	☒
Channel -1	☒
Channel +1	☒
Channel +2	☒

Code Domain Power Configuration – Setup: CDP/Code Auto

Default All Settings	☑
CDP/Code Auto	
Default Settings	☑
Display Spreading Factor	Auto
Repetition	Continuous
Grid	On
CDP/Code Manual	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Display Mode	Current
Grid	On

Code Domain Power Configuration – Setup: Default All Settings

	Min. P.	Max. P.
Default All Settings	☐	
CDP/Code Manual		
Default Settings	☐	
Limit Values Cur. & Max/Min.		
DPCCH	- 10.0 dB	0.0 dB
DPDCH 1	- 10.0 dB	0.0 dB
DPDCH 2	- 10.0 dB	0.0 dB
DPDCH 3	- 10.0 dB	0.0 dB
DPDCH 4	- 10.0 dB	0.0 dB
DPDCH 5	- 10.0 dB	0.0 dB
DPDCH 6	- 10.0 dB	0.0 dB
Limit Values Average		
DPCCH	- 10.0 dB	0.0 dB

WCDMA FDD Spectrum

Max. Level: Auto Normal RF Chan./RF Freq.: 9612 / 1922.4 MHz
RF Freq. Offset: + 0.000 kHz
OBW l.: - 2.08 MHz
OBW r.: 2.06 MHz

20.000 kHz Resolut. Bandwidth
2560 chips Meas. Length
9.05 dBm UE Power
10 Statistic Count
0.00 % Out of Tolerance

- 10.00 MHz	- 5.00 MHz	0 MHz	+ 5.00 MHz	+ 10.00 MHz	OBW	
- 51.4	- 50.2	+ 8.8 dBm	- 50.1	- 51.3	4.16 MHz	Curr.
- 51.4	- 50.1	+ 8.8 dBm	- 50.1	- 51.4	4.15 MHz	Avg.
- 51.3	- 49.8		- 49.9	- 51.2	4.18 MHz	Max.

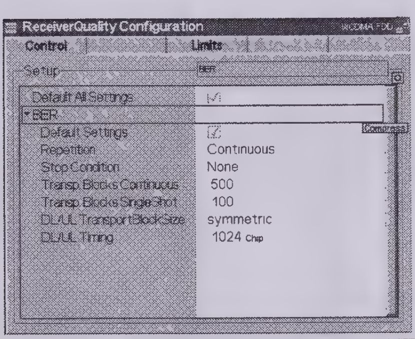
All Values in dB

WCDMA FDD Code Domain Power

Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz
DPDCH Symbol Rate: 960 ksps
Threshold: - 3 dB CC1: 1 CC2: 1 CC3: 2 CC4: 3 CC5: 3 CC6: ---

14 Slot Number
6.27 dBm UEPower
ErrVectMagn. - RMS 1.5 %
I/Q Origin Offset - 63.22 dB
Carrier Freq. Error 142 Hz

Receiver Quality

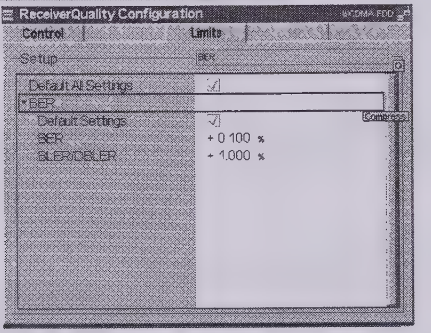

ReceiverQuality Configuration
WCDMA FDD
Control
Limits
Compress

Setup: BER

Default All Settings ☑

BER

Default Settings ☑
Repetition: Continuous
Stop Condition: None
Transp. Blocks Continuous: 500
Transp. Blocks SingleShot: 100
DL/UL TransportBlockSize: symmetric
DL/UL Timing: 1024 Chip

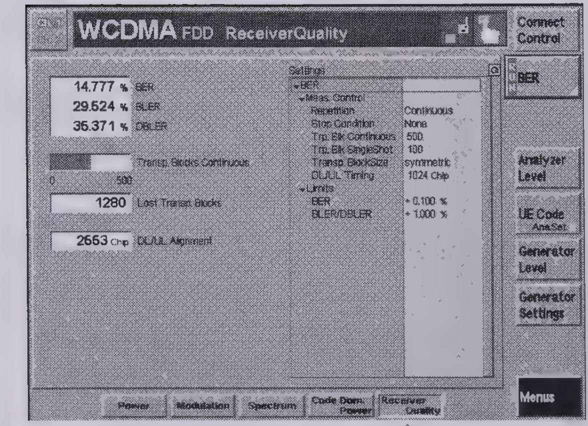

ReceiverQuality Configuration
WCDMA FDD
Control
Limits
Compress

Setup: BER

Default All Settings ☑

BER

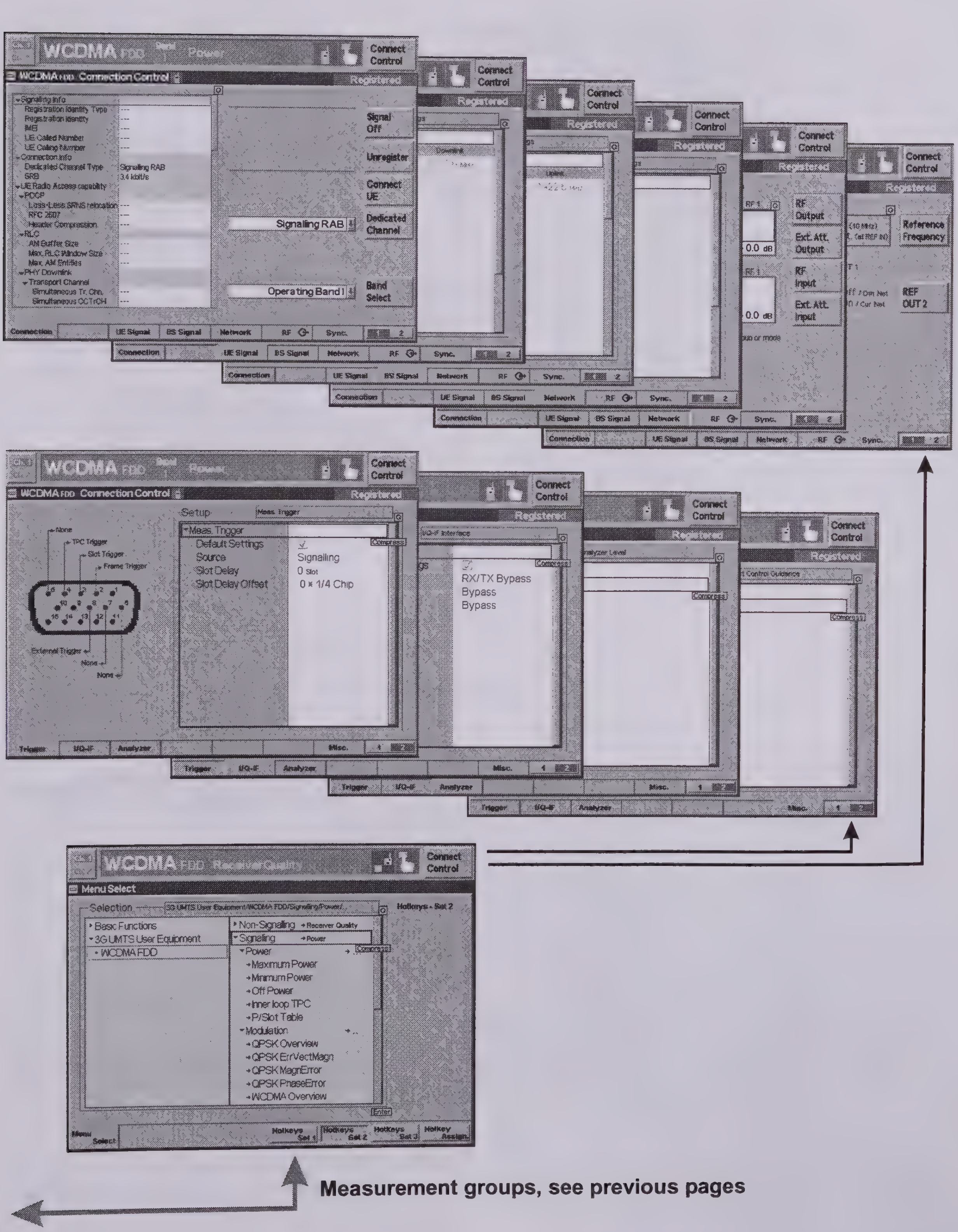
Default Settings ☑
BER: + 0.100 %
BLER/DBLER: + 1.000 %


WCDMA FDD ReceiverQuality
Connect Control
BER
Analyzer Level
UE Code Ana.Set.
Generator Level
Generator Settings
Menus
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality
0
500

14.777 % BER
29.524 % BLER
35.371 % DBLER
Transp. Blocks Continuous
1280 Lost Transp. Blocks
2653 Chip DL/UL Alignment

Settings
BER
Meas. Control
Repetition: Continuous
Stop Condition: None
Trp. Blk Continuous: 500
Trp. Blk SingleShot: 100
Transp. BlockSize: symmetric
DL/UL Timing: 1024 Chip
Limits
BER: + 0.100 %
BLER/DBLER: + 1.000 %

Signalling: Connection Control



WCDMA FDD Connection Control

- Signaling Info
  - Registration Identity Type ---
  - Registration Identity ---
  - IMEI ---
  - UE Called Number ---
  - UE Calling Number ---
- Connection Info
  - Dedicated Channel Type Signaling RAB
  - SRB 3.4 kbit/s
- UE Radio Access capability
  - PDCP
    - Loss-Less SRNS relocation ---
    - RFC 2507 ---
    - Header Compression ---
  - RLC
    - AM Buffer Size ---
    - Max. RLC Window Size ---
    - Max. AM Entities ---
  - PHY Downlink
    - Transport Channel
      - Simultaneous Tr. Chn. ---
      - Simultaneous CCTrCH ---

Signalling RAB

Operating Band I

Setup: Meas. Trigger

- Meas. Trigger
  - Default Settings ✓
  - Source Signalling
  - Slot Delay 0 Slot
  - Slot Delay Offset 0 × 1/4 Chip

RX/TX Bypass
Bypass
Bypass

Menu Select

Selection: 3G UMTS User Equipment/WCDMA FDD/Signaling/Power/...

WCDMA FDD
Power
Connect Control
Registered
Signal Off
Unregister
Connect UE
Dedicated Channel
Band Select
Connection
UE Signal
BS Signal
Network
RF
Sync.
2
Downlink
Uplink
RF 1
0.0 dB
RF Output
Ext. Att. Output
RF Input
Ext. Att. Input
Reference Frequency
REF OUT 2
None
TPC Trigger
Slot Trigger
Frame Trigger
External Trigger
None
None
I/Q-IF Interface
Analyzer Level
Compress
Trigger
I/Q-IF
Analyzer
Misc.
1
WCDMA FDD Receiver Quality
Hotkeys - Set 2
Basic Functions
3G UMTS User Equipment
WCDMA FDD
Non-Signalling → Receiver Quality
Signalling → Power
Power
Maximum Power
Minimum Power
Off Power
Inner loop TPC
P/Slot Table
Modulation
QPSK Overview
QPSK ErrVectMagn
QPSK MagnError
QPSK PhaseError
WCDMA Overview
Enter
Menu Select
Hotkeys Set 1
Hotkeys Set 2
Hotkeys Set 3
Hotkey Assign

Measurement groups, see previous pages

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4 Functions and their Application

This chapter provides detailed information on the measurement and configuration menus defined in the WCDMA UE function groups. It is organized like a typical measurement session including the following stages:

1. Measurement menus *(Power, Modulation, Spectrum, Code Domain Power, Receiver Quality):* purpose and principle of the measurements and relation to conformance test specifications, description of measurement results, specific measurement configurations. The measurements are largely analogous in Non Signalling and Signalling mode. Menu examples are taken from Non Signalling mode; differences between both modes are pointed out through the text.
2. Global configurations in Non Signalling mode *(Connection Control)*
3. Measurements and global configurations in Signalling mode *(Connection Control)*

This reference chapter is thus organized according to the provided measurements and configurations (see graphical overview at the end of chapter 3). In contrast to chapter 6, *Remote Control – Commands,* general measurement configurations are relegated to the end of each section. The description of each softkey, select or input field is followed by the corresponding remote-control commands. Similarly, the description of the commands in chapter 6 also contains the corresponding menus of the user interface.

Each menu and each panel is briefly described first and then illustrated together with its call button. The menu functions are explained in the following way:

Softkey Short function definition

Designation of select/input field Definition of field function.

Further description of the field: purpose, interaction with other settings, notes...

Parameter 1	Description of parameter 1
Parameter 2	Description of parameter 2

...

Further description of the parameters: purpose, interaction with other settings, notes...

Remote control `Remote-control command (long form)  Parameter1 | Parameter2`
`...`

For all numerical values, including their ranges and default settings, please refer to the description of the remote-control commands in chapter 6.

The description of the operating concept is to be found in chapter 3 of the operating manual for the CMU200/CMU300 basic instrument. Besides, a description of measurement control and the essential settings and an overview of the most important menus is given at the end of chapter 3 in the present WCDMA manual. A comprehensive index listing important keywords and the proper names of all menus, dialog elements and softkeys is appended to the end of this manual.

Power Measurements

The menu group *Power* comprises the functions for measuring the power of the received RF carrier signal and testing the inner loop power control. The results are displayed in the measurement menu *Power,* the popup menu *Power Configuration* is used for configuration of the measurements.

WCDMA Power Control

In CDMA networks, control of the UE transmitter power is essential to ensure stable transmission and an efficient radio resource management within the system. Generally speaking, an output power of the UE transmitter that is too low decreases the coverage area while an excess output power may cause interference to other channels or systems. Both effects decrease the system capacity.

The *Power* measurement group is used to determine the peak output power of the UE *(UE Power (Peak)),* i.e. the Peak Envelope Power (PEP) of the WCDMA signal and the output power averaged over the transmit slot *(UE Power (RMS)).* The PEP is usually a few dB higher than the RMS-averaged WCDMA signal power; the level difference is termed crest factor. Both the *UE Power (Peak)* and the *UE Power (RMS)* can be measured under various operating conditions of the UE and the tester. The operating conditions correspond to the five power *Applications* that can be selected on the CMU:

Maximum Power

In the *Maximum Power* application, the tester commands the UE to transmit at its maximum power control level by continuously sending Up power control commands to the UE. When the maximum power control level is reached, the UE output power is measured and averaged over the whole transmit slot (666.7 µs).

The *Maximum Power* is measured with a wide-band filter with a bandwidth >5 MHz.

Minimum Power

In the *Minimum Power* application, the tester commands the UE to transmit at its minimum power control level by continuously sending Down power control commands to the UE. When the minimum power control level is reached, the UE output power is measured and averaged over the whole transmit slot (666.7 µs).

The *Minimum Power* is measured with a wide-band filter with a bandwidth >5 MHz.

OFF Power

In the *OFF Power* application, the UE transmitter is set to the transmit OFF power state where it does not transmit except during uplink compressed mode. The OFF power (leakage power) is measured as the maximum power within the transmit channel bandwidth while the transmitter is off (i.e. excluding any transitory periods). This power is averaged over the whole transmit slot (666.7 µs).

The *OFF Power* measurement is performed on the carrier frequency of the transmit channel with a filter that has a RRC filter response with a roll-off $\alpha = 0.22$ and a bandwidth equal to the chip rate (3.84 MHz).

Inner Loop TPC

In the *Inner Loop TPC* application, the UE transmitter is set to change its output power with a step size of 1 dB, 2 dB, or 3 dB (3 dB in Non Signalling mode only). Depending on the transmit power control algorithm used, power steps may occur after each slot or after groups of 5 slots only. The UE power level is averaged over the transmit slot minus a guard period of 25 µs at the beginning and at the end of the slot and the power step error is measured in a variable number of consecutive slots. A limit check on the power step errors taking into account the minimum and the maximum power thresholds is performed in addition.

The *Inner Loop TPC* measurement is performed on the carrier frequency of the transmit channel with a wide-band filter with a bandwidth >5 MHz.

P/Slot Table

In the *P/Slot Table* application, the RMS UE transmitter power can be measured in up to 100 consecutive or equidistant slots. *P/Slot Table* is a real-time measurement that was primarily designed for quick evaluation of power steps of the UE transmitter over a wide dynamic range (see also the application example reported in Chapter 2).

The *P/Slot Table* measurement is performed on the carrier frequency of the transmit channel with a wide-band filter. The accuracy of all *Power* measurements is quoted in the data sheet.

Openloop Power The openloop power measurement provides the power of the first PRACH preamble transmitted when the UE initiates a registration or when a connection is set up. The openloop power measurement is not available in *Non Signalling* mode and not treated as an application of the *Power* menu. It is controlled in the *Connection* tab of the *Connection Control* menu; see section *Connection – RF Channel and Power.*

Important Note 1: OFF Power

At present, the CMU is not able to command the UE to enter its transmit OFF state. This must be reached by other means before selecting a Power *application.*

Important Note 2: Maximum Power, Minimum Power

By default, the CMU changes its TPC pattern to command the UE to transmit at maximum or minimum power as soon as the corresponding power application is initiated. Alternatively, it is possible to deactivate automatic power setting in order to set the UE power manually; see TPC *parameter in section Measurement Control (Power Configuration – Control)* on p. *4.18 ff. It is also possible to change the TPC pattern sent to the UE while the power application is active, e.g. to test the drift of the UE transmitter.*

Important Note 3: Inner Loop TPC

To achieve correct Inner Loop TPC *results, it is necessary to stimulate the UE to perform power steps, to adjust the CMU test settings to the UE signal and to use an appropriate trigger. Possible test setups are listed in section Test Scenarios for Inner Loop TPC on p.* 4.3 *ff.*

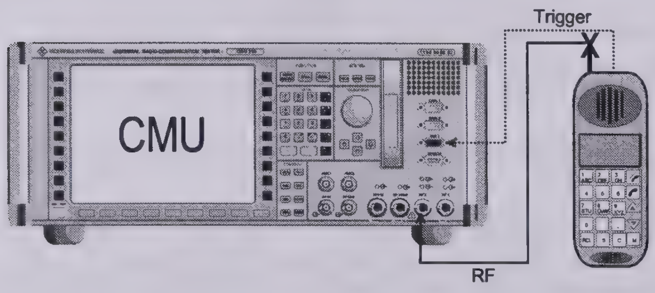
Important Note 4: P/Slot Table

The P/Slot Table measurement requires an external trigger with a correct timing; see Fig. 4-8 on p. 4.25. Ideally the UE provides an external trigger signal that is correlated to its power steps to be measured. If no such external trigger is available the measurement can be performed with the internal frame trigger provided by the DL generator.

Test Scenarios for Inner Loop TPC

An *Inner Loop TPC* measurement can be performed in different ways. The following scenarios are intended as a short introduction; all test settings are explained in detail in the following sections.

Scenario 1: Independent UE under test

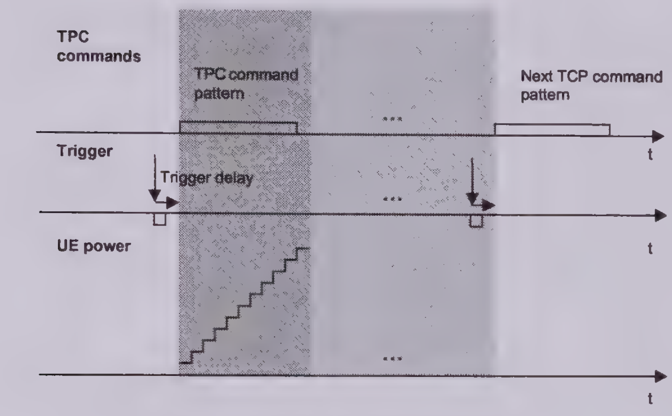


The UE receives a TPC command pattern (to be set internally or by external means) and is stimulated to perform power steps, obeying the rules described below. The CMU test settings are set to comply with the expected RF signal from the UE *(TPC command* pattern, *TPC Mode, Step Size).*

- If the *TPC Mode* at the CMU is set to *Off*, the TPC command pattern may be arbitrary (unknown) but the UE must change its power after each slot. The measurement can be performed in *Free Run* mode, or an *External* trigger from the UE can be used.
- If the *TPC Mode* is set to *Algorithm 1* or *Algorithm 2*, the UE must provide a TPC command pattern that is periodic in time and a periodic external trigger signal *(Trigger Source = External).*

External trigger settings:

The figure below illustrates the way a measurement is performed and the trigger timing. The dark shaded area corresponds to the measured and displayed time range (section A, integer number of slots). The light shaded area shows the time elapsed until the start of the next measurement cycle (including section B, if it is activated).

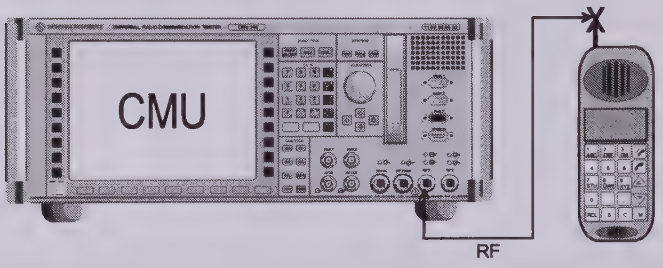


An external trigger can be set as follows:

- The trigger signal must be related to both the periodic UE signal and the start of the measurement (section A).
- The CMU is capable of compensating for a possible delay between the trigger time in the UE signal and the start of section A; see *Trigger Delay* in section *Trigger (Connection Control – Trigger)* on p. 6.136 ff.

Note the *Rules for UE power steps and TPC commands* below.

Scenario 2: Synchronization via RF Generator (with Option CMU-K66)



The CMU's internal RF generator synchronizes the UE under test and triggers the measurement *(Trigger Source = Internal)*. It also transfers the TPC command pattern to the UE. The internal trigger signal is a TPC trigger: The trigger time coincides with the beginning of the TPC profile of the UL signal (see description of internal trigger in section *Trigger (Connection Control – Trigger)* on p. 6.136 ff. The UE is stimulated to perform power steps, using the TPC command pattern received and obeying the rules described below. The CMU test settings are set to comply with the expected RF signal from the UE *(TPC Mode, Step Size)*.

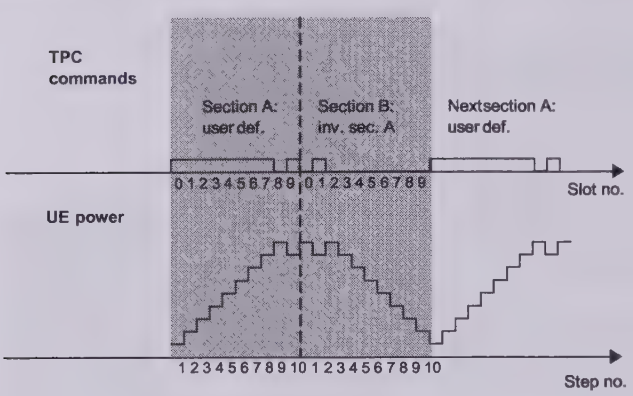
- Use of *TPC Mode = Off* at the CMU is possible but typically used in test scenario 1 where no TPC command pattern is transferred.
- *TPC Mode = Algorithm 1* or *Algorithm 2* is set at the CMU and at the UE. In contrast to scenario 1, no external trigger is required.

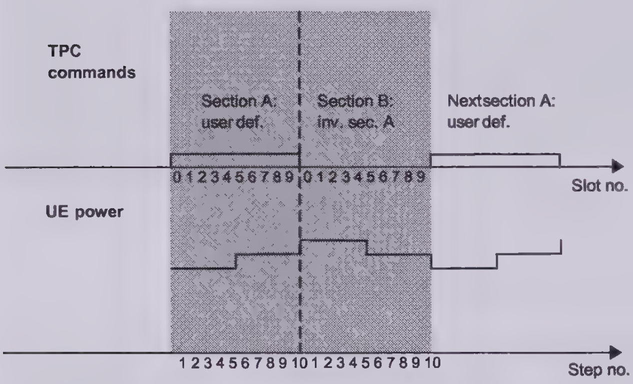
Note: *In the* Inner Loop TPC *measurement with internal trigger, the timing is exclusively determined by the TPC trigger time and the trigger delay parameters* (Slot Delay + Delay Offset). *In contrast to other measurements the CMU does not perform a correlation analysis to exactly pin down the beginning of the UL slot (see Fig. 4-60 on p. 4.129). The accuracy of the (corrected) trigger time must be «25 μs to ensure that the measurement range is actually confined to the central domain of the slot (see Fig. 4-7 on p. 4.24).*

Synchronized Inner Loop TPC measurements can be performed in Non Signalling and in Signalling mode.

Rules for UE power steps and TPC commands

The UE test settings must not conflict with the measurement settings and algorithms of the CMU. The following few rules will help to avoid trouble, especially if the UE under test is operated according to test scenario 1 or if section B is switched on.





1. In the *TPC Mode = Algorithm 1* setting the CMU expects the TPC command pattern to be symmetric in time and inverted in sections A and B of the test diagram. The resulting power ramp is symmetric in time. The section A and section B patterns must follow each other without a time gap.

   (Let the total number of TPC commands per section be N (N = 7 or 10). Then a TPC command 1 in slot no. n of section A implies a TPC command 0 in slot no. N – n in section B and vice versa. This condition can be ignored if section B is switched off.)

2. In the *TPC Mode = Algorithm 2* setting the output power can be changed after each 5th slot only. The number of commands in the TPC command pattern must be a multiple of 5. The start of each pattern must be aligned to slot 0, 5, or 10 of any frame. To obtain a symmetric UE power ramp from a symmetric TPC pattern, one of the following conditions must be met:
   - Section A and B contain 10 power steps each (see figure on the left side).
   - The TPC command pattern is such that the UE power is constant over both sections (0 dB power steps only).

3. In the *TPC Mode = Algorithm* 1 or *Algorithm 2* settings the TPC command pattern used by the UE must be repeated periodically in time if the measurement is to be made in *Continuous* mode. An alternative is a measurement with a single TPC pattern transferred to the UE *(TPC Pattern Type = Single Pattern + All 0/Single Pattern + All 1/Single Pattern +Alternating; see Table 4-16* on p. *4.125*) and (preferably) section B switched off.

4. The TPC command pattern may be longer than the number of slots measured, however, the residual part of the pattern must not effectively change the UE output power between the last slot measured and the first slot of the next measurement cycle. Otherwise subsequent measurements will be performed at increasing or decreasing power levels.

Measurement Menu (Power)

The *Power* measurement menu shows the results of the *Power* measurement.

- The measurement control softkey Maximum Power (which changes to Minimum Power or OFF Power, Inner Loop TPC or P/Slot Table, depending on the power measurement application selected) controls the Power measurement, indicates its status (RUN | HLT | OFF), and opens the configuration menu Power Configuration. The hotkeys associated to the measurement control softkey define the scope of the Power measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys (e.g. the hotkeys RF Channel, RF Frequency, and RF Frequ. Offset are associated with the softkey Analyzer

Settings). If a softkey is selected and an associated hotkey pressed, a popup window will appear which indicates the current setting and enables an entry.

The measurement menu *Power* can be accessed from any other measurement menu of the WCDMA UE function group using the *Power* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

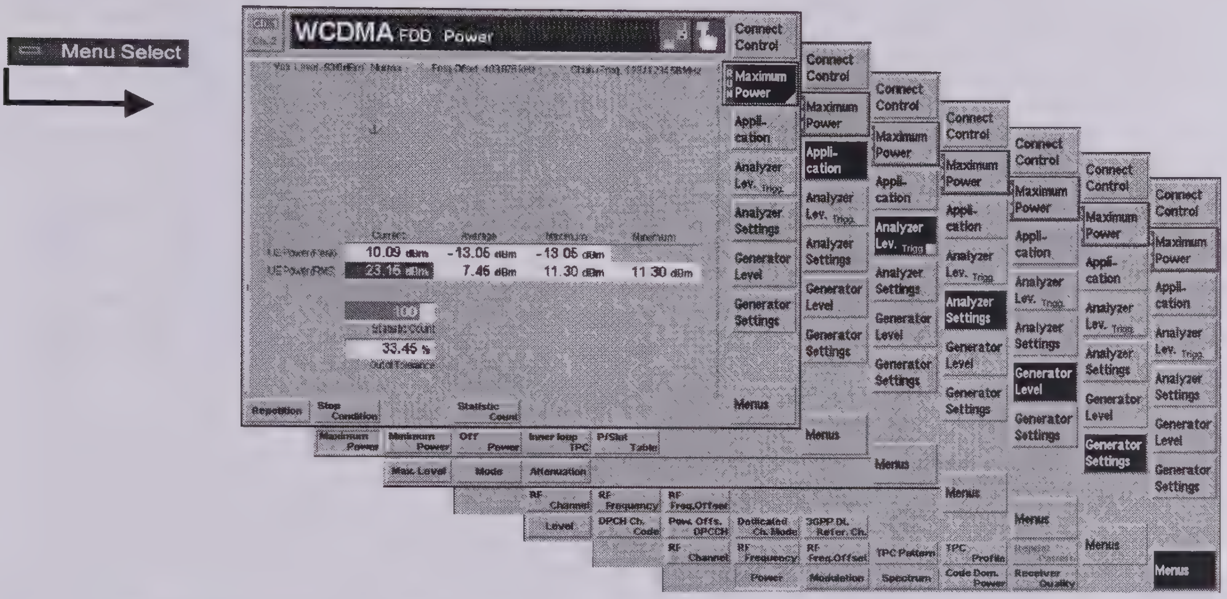

Menu Select
WCDMA FDD Power
Connect Control
Maximum Power
Appli-cation
Analyzer Lev. Trigg.
Analyzer Settings
Generator Level
Generator Settings
Menus
10.09 dBm
-13.06 dBm
-13.05 dBm
23.15 dBm
7.46 dBm
11.30 dBm
11.30 dBm
100
Statistic Count
33.45 %
Out of Tolerance
Repetition
Stop Condition
Statistic Count
Maximum Power
Minimum Power
Off Power
Inner loop TPC
P/Slot Table
Max. Level
Mode
Attenuation
RF Channel
RF Frequency
RF Freq.Offset
Level
DPCH Ch. Code
Pow. Offs. DPCCH
Dedicated Ch. Mode
3GPP DL Refer. Ch.
TPC Pattern
TPC Profile
Code Dom. Power
Receiver Quality
Power
Modulation
Spectrum

Fig. 4-1 Measurement menu Power

Test Settings

The basic settings for the *Power* measurement are directly accessible from the measurement menu via softkey/hotkey combinations. If a softkey is selected and an associated hotkey is pressed, a popup window will appear which indicates the current setting and enables an entry.

Example:

Analyzer Settings

The *Analyzer Settings* softkey displays a hotkey bar including the hotkey *RF Channel*.

RF Channel

The *RF Channel* hotkey defines the WCDMA channel number of the analyzed RF signal.

RF Channel
961

Input windows indicate the current parameter value (in this case: the WCDMA channel number of the analyzed RF signal) or a list of possible settings. Parameters are changed by

- Overwriting/incrementing numerical values (for numeric parameters)
- Selecting from the list of parameters (for select parameters)

Many of the basic settings are also accessible from the *Power Configuration* popup menu. They are explained in more detail in the *Measurement Configurations (Power Configuration)* section on page 4.18 ff. All softkeys and hotkeys in the *Maximum Power* application are shown in *Fig. 4-1 above*.

Maximum Power

The *Maximum Power* softkey controls the maximum power measurement and indicates its status *(RUN | HLT | OFF)*. This softkey changes to *Minimum Power* or *OFF Power,* or *Inner Loop TPC*, depending on the power measurement application selected; see *Application* softkey below.

The measurement status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Power* measurement; however, a running measurement is restarted.

Remote control

```
INITiate:POWer:<Application>
ABORt:POWer:<Application>
STOP:POWer:<Application>
CONTinue:POWer:<Application>
```

Measurement configuration

Pressing the Maximum Power softkey twice opens the popup menu Power Configuration (see page 4.18). Besides, hotkeys defining the scope of the measurement are associated to the Maximum Power softkey. The settings are also provided in the Control tab of the Power Control menu and described in section *Measurement Control (Power Configuration – Control)* on page 4.18 ff.). Some of them are not available for all applications.

Application

The *Application* softkey sets the operating condition of the UE where the Power measurement is performed. For a detailed description see background information in section *Power Measurements* on p. 4.2.

The alternative measurements (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.18 ff.).

Maximum Power

The *Maximum Power* hotkey selects the measurement of the maximum power the UE is able to transmit.

Remote control
The *Maximum Power* application is selected by the keyword `:MAXimum` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:MAXimum...`

Minimum Power

The *Minimum Power* hotkey selects the measurement of the minimum power the UE is able to transmit.

Remote control
The *Minimum Power* application is selected by the keyword `:MINimum` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:MINimum...`

OFF Power

The *OFF Power* hotkey selects the measurement of the maximum output transmit power within the channel bandwidth when the transmitter is OFF.

Remote control
The *OFF Power* application is selected by the keyword `:OFF` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:OFF...`

Inner Loop TPC

The *Inner Loop TPC* hotkey selects the Inner loop Transmit Power Control measurement.

Remote control
The *Inner Loop TPC* application is selected by the keyword `:ILTPc` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:ILTPc...`

P/Slot Table

The *P/Slot Table* hotkey selects the measurement of the RMS power of the UE in up to 100 slots, displayed in a table.

Remote control
The *P/Slot Table* application is selected by the keyword `:XSLot` in the 3rd level of the `POWer` commands, e.g. `CONFigure:POWer:XSLot...`

Analyzer Level Trigg.

The *Analyzer Level/Trigger* toggle softkey controls the level in the RF input signal path and provides the trigger settings for the *Power* measurement. Pressing this softkey repeatedly toggles between the input level and the trigger settings

The input level settings are described in more detail in section *Analyzer Settings (Connection Control – Analyzer)* on p. *6.105* ff.; the trigger settings in section *Trigger (Connection Control – Trigger)* on p. *6.136* ff.

Analyzer Settings

The *Analyzer Settings* softkey determines the frequency of the RF signal analyzed. The *RF Channel* and *RF Frequency* settings override each other according to the definition of the WCDMA channels. The analyzer settings and the WCDMA channel structure are described in more detail in section *Analyzer Settings (Connection Control – Analyzer)* on p. 6.105 ff.

UE Code Ana. Sett.

The *UE Code* softkey defines properties of the multiple uplink WCDMA signal that the CMU analyzes to test the *Inner Loop TPC*. This softkey is available only if application *Inner Loop TPC* is selected.

For a description of the WCDMA signal see background information in section *Measurement Menu (Modulation – WCDMA)* on page 4.45 f. More *UE Code* settings are accessible via the *UE Code* tab of the *Connection Control* menu; see section *Uplink Signal (Connection Control – UE Code)* on p. 6.127 ff. The *Inner Loop TPC* measurement fails if the input signal does not conform to the *UE Code* settings.

If pressed once again, the selected *UE Code* softkey changes to the *Analyzer Settings* softkey, see above.

Generator Level

The *Generator Level* softkey (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only) configures the downlink Dedicated Physical Channel (DPCH) contributing to the RF generator signal. The generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. 6.109 ff.

Generator Settings

The *Generator Settings* softkey (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only) determines the frequency of the generated RF carrier signal and the TPC pattern. The generator settings are described in more detail in section *Generator Settings (Connection Control – Generator)* on p. 6.109 ff. *TPC Pattern Config.* opens a popup menu to define the *Transmit Power Control (TPC)* information transmitted on the DPCH.

Marker Display

The *Marker/Display* softkey positions up to 3 markers in the test diagram and displays their values.

If pressed once again, the selected *Marker/Display* softkey changes to the *Display/Marker* softkey, see below. Both softkeys are only available in the *Inner loop TPC* application where a two graphical diagrams are displayed.

Markers The markers are graphical tools for marking points on the measurement curve and for numerical output of measured values. The measurement menu *Power* provides a reference marker and two

additional absolute markers for each of the two diagrams.
The coordinates of the three markers are indicated in the format Ordinate value (absolute or relative power) / abscissa value (slot no.) in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (absolute power in dBm, relative power in the lower diagram in dB and time in bits), the delta marker by absolute or relative values (relative power in dB or time differences from the reference marker).

Ref R

The hotkey *Ref. R* switches the reference marker on or off (use the *ON/OFF* key).

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker is switched off in the default setting *(Off)*. The marker value represents the measurement result at the marker position. The position of all markers can be varied using the roll-key.

Remote control
No command, screen configuration only.

Abs. 1

The *Abs. 1 (2)* hotkeys switch marker 1 (2) on or off (use the *ON/OFF* key). The marker 1 (2) is represented by the symbol 1 (2) in the test diagram. If configured as an absolute marker, it is equivalent to the reference marker.

The toggle switch *Marker* pops up when the hotkey is pressed for the second time. It defines whether the position of marker 1 is measured and indicated in *absolute* units or *relative* to the reference marker. Selecting *relative* changes the hotkey labeling into *Rel. 1 (2)*.

Remote control
No command, screen configuration only.

UE P. Error

The *UE P. / Error* toggle switch activates the marker settings for either the upper *(UE Power)* or the lower *(Power Step)* diagram.

Remote control
No command, screen configuration only.

Display Marker

The *Display/Marker* softkey scales the axes and provides further display configurations for the *Inner Loop TPC* diagrams. It is activated by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see above.

All *Display/Marker* settings are explained in more detail in section *Measurement Control (Power Configuration – Control)* on p. 4.18 ff.

Menus

The *Menus* softkey displays the hotkey bar for changing to the other measurement groups. Pressing a hotkey directly opens the main measurement menu within the corresponding measurement group.

Measurement Results

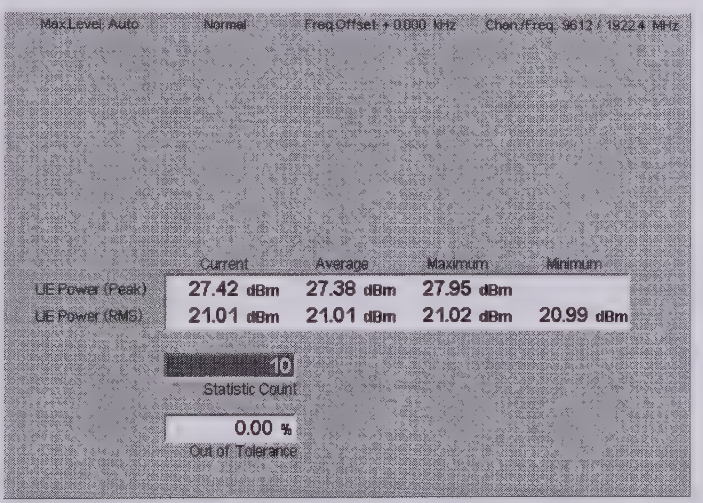
The values shown in the *Power* measurement menu can be divided into three groups:

- Settings
- Single measurement results (referred to as scalar values in remote control; see Chapters 5 and 6)
- Curves and bar graphs plotted in diagrams as a function of time (referred to as arrays in remote control)

The measurement menus for the three applications *Max. Power, Min. Power*, and *Off Power* are analogous. They show scalar UE power results but no graphical diagram. The *Inner Loop TPC* menu contains two diagrams to show the UE power and the power steps in a sequence of slots. The *P/Slot Table* menu contains a table to display the (scalar) RMS powers in up to 100 slots.

Maximum Power, Minimum Power, Off Power

The three measurement menus for the applications *Maximum Power, Minimum Power,* and *OFF Power* contain a parameter line, an output table, and two additional output fields. Except for the minimum of the *UE Power (RMS),* the results in the three applications are analogous.



Parameter line

Output table

Output fields

Max.Level: Auto   Normal   Freq.Offset: + 0.000 kHz   Chan./Freq.: 9612 / 1922.4 MHz

	Current	Average	Maximum	Minimum
UE Power (Peak)	27.42 dBm	27.38 dBm	27.95 dBm	
UE Power (RMS)	21.01 dBm	21.01 dBm	21.02 dBm	20.99 dBm

Statistic Count: 10

Out of Tolerance: 0.00 %

Fig. 4-2 Display of results (Maximum Power)

Test settings The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

The output fields below the table contain the following settings:

Statistic Count	Number of slots per statistics cycle as set in the *Control* tab of the *Power Configuration* menu; see p. 4.18 ff. The colored bar indicates the relative progress of the measurement within the statistics cycle.

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Scalar measurement results

The quantities in the output table are measured for consecutive slots. The results of the current slot are entered in the first table column. From the *Current* results, the *Average* referenced to a statistics cycle (see averaging rules in Chapter 3, section *General Settings)* and the *Maximum* and *Minimum* of all values determined in the current measurement is calculated. The *Current* results are measured as follows:

UE Power (Peak)	Maximum output power of the UE transmitter within the transmit slot
UE Power (RMS)	Output power of the UE transmitter averaged over the whole transmit slot (666.7 µs)

The measurements are done with the filter settings quoted in section *Power Measurements* on p. 4.2.

Note: *A* Minimum *value that is clearly distinct from the noise floor can be expected for* Maximum Power *measurements only. In the* Maximum Power *test, both upper and lower limits are specified in 3GPP. Excess power causes the increase of interference to other code channels, and less power causes the degradation of the own code channel. In the two other applications, a small power is desirable, so no lower limits are specified and the* Minimum *column of the output table is omitted.*

In addition, the following scalar result is indicated:

Out of Tolerance	Relative number of slots that are out of the tolerances defined by the limits.

Limit Check

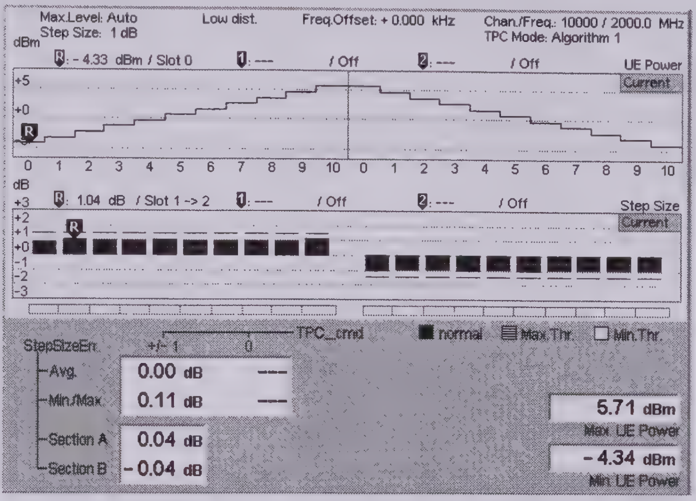
A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Power Configuration* menu, see p. 4.25 ff.

Remote control

```
READ[:SCALar]:POWer<Application>?
CALCulate[:SCALar]:POWer<Application>:MATChing:LIMit?
FETCh[:SCALar]:POWer<Application>?
SAMPle[:SCALar]:POWer<Application>?
```

Inner Loop TPC

The values in the *Inner Loop TPC* measurement menu are indicated in two parameter lines, two diagrams, and various output fields.


Parameter line

Output table

Output fields

Max.Level: Auto
Step Size: 1 dB
Low dist.
Freq.Offset: + 0.000 kHz
Chan./Freq.: 10000 / 2000.0 MHz
TPC Mode: Algorithm 1

R: - 4.33 dBm / Slot 0 1: --- / Off 2: --- / Off

R: 1.04 dB / Slot 1 -> 2 1: --- / Off 2: --- / Off

StepSizeErr.
Avg. 0.00 dB ---
Min./Max. 0.11 dB ---
Section A 0.04 dB
Section B - 0.04 dB

5.71 dBm Max. UE Power
- 4.34 dBm Min. UE Power

Fig. 4-3 Display of results (Inner Loop TPC)

Test Settings/ Scalar results Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

1st parameter line The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

2nd parameter line The second parameter line contains *Inner Loop TPC* test settings defined in the configuration menu (see section *Measurement Control (Power Configuration – Control)* on p. 4.18 ff.):

Step Size	Transmitter output power step size (inner loop power step)
TPC Mode	Algorithm for processing TPC commands

Remote control
Settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Upper diagram: UE Power The upper diagram in the *Inner Loop TPC* measurement menu contains two sections (termed A and B). In each section, the average transmitter output power of the UE is displayed in 8 or 11 consecutive slots, depending on the *Profile Length* settings (slot no. 0 to n where n is the *Profile Length*; see p. 4.20). The UE power is averaged over the measured slots, not including the transient duration, which is from 25 µs before the slot boundary to 25 µs after the slot boundary.

The measurement in section B can be switched on or off to meet the particular requirements of a measurement task (see *Section B Analysis* on p. 4.22, note in particular the trigger conditions for section B). Unless the *TPC Mode* is set to *Off* or only a single shot measurement is made, the TPC command pattern determining the UE power steps (see *Step Control* on p. 4.23) must be periodic and repeat without gaps. Although section B is measured in a second cycle, it is expected to be directly adjacent to section A. The TPC commands in section A and B must be symmetric. The symmetry of the diagram depends on the power control algorithm; for details refer to section *Test Scenarios for Inner Loop TPC* on p. 4.3 ff.

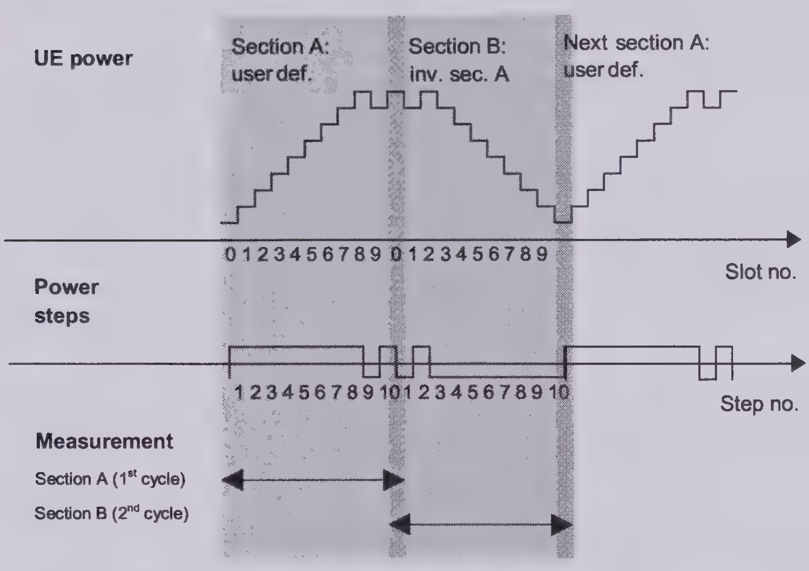


Fig. 4-4 Display of UE power and power steps

In the UE power diagram, the last slot (slot no. 7 or 10) of section A in the first measurement cycle corresponds to the first slot (slot no. 0) of section B in the second cycle. Up to the delay between the first (section A) and the second (section B) measurement cycle, both sections are measured and displayed with a 1-slot overlap. The UE power in the overlapping slot must be identical unless the UE shows a power drift between the first and the second cycle. The time scale of a measurement with *Profile Length = 10 Slots* is shown in *Fig. 4-4 above*. The repetition of the overlapping slot ensures a consistent representation of the UE power, the power steps (lower diagram) and their symmetry in both diagram sections.

The y-axis scale of the diagram is automatically adapted to the input power range. The results are in absolute (dBm) units.

Remote control

```
READ:ARRay:POWer:ILTPc:UEPower:CURRent?
FETCh:ARRay:POWer:ILTPc:UEPower:CURRent?
SAMPle:ARRay:POWer:ILTPc:UEPower:CURRent?
```

Lower diagram: Power Step

The lower diagram in the *Inner Loop TPC* measurement menu contains two sections (termed A and B). In each section, one of the quantities selected via *Step Analysis (Power Step, Abs. Power Step*, or *Power Step Error;* see p. 4.22) is displayed in 7 or 10 consecutive slots, depending on the *Profile Length* settings (see p. 4.20). To obtain the power steps, the UE power of the original slot is subtracted from the UE power of the target slot. The UE powers are measured according to the rules described above for the upper diagram.

The measurement in section B can be switched on or off to meet the particular requirements of a measurement task (see *Section B Analysis* on p. 4.22). The symmetry of the diagram depends on the displayed quantities and the power control algorithm; for details refer to section *Test Scenarios for Inner Loop TPC* on p. 4.3 ff.

The y-axis scale of the diagram is automatically adapted to the range of input values. The results are in relative (dB) units.

Remote control

```
READ:ARRay:POWer:ILTPc:STEP:CURRent?
FETCh:ARRay:POWer:ILTPc:STEP:CURRent?
SAMPle:ARRay:POWer:ILTPc:STEP:CURRent?
```

Limit Check (Power Step)

The pairs of horizontal red lines in the diagram represent the power step tolerances set in the *Limits* tab of the configuration menu; see section *Tolerance Values (Power Configuration – Limits)* on p. 4.25 ff. If a limit is exceeded, the corresponding section of the bar across the bottom of the diagram turns red.

The legend *(normal, Max. Thr., Min. Thr.)* below the diagram refers to the *Max. Threshold* and *Min. Threshold* values set in the *Limits* tab:

- A hatched blue bar indicates that the current power step increases the UE power to a value above the *Max. Threshold*. The lower power step error limit is no longer valid so the lower limit line is erased.
- A white bar indicates that the current power step decreases the UE power to a value below the *Min. Threshold*. The upper power step error limit is no longer valid so the upper limit line is erased.
- A solid blue bar is displayed in all other cases. In particular, if the final UE power is in the range between *Min. Threshold* and *Max. Threshold*, both the lower and the upper power step error limits are checked.

Note: *The Step Analysis parameter (see p. 4.22) determines the displayed quantity and the diagram but does not affect the limit check. If* Abs. Power Steps *are displayed, a sign error (e.g. a power step of –1 dB following a TPC_cmd value of +1) does not show in the diagram* (Abs. Power Step = + 1 dB *and therefore below the default limit line), but is indicated in the bar across the bottom of the diagram.*

Remote control

```
CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATCHing:LIMit?
CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit?
```

Output Table: Power Step Err.

The output table below the diagram lists the *Power Step Error* as a function of the transmitter output power *Step Size* and as an average over half of the diagram width. This quantity is equal to the error in the inner loop power step, i.e. the difference between the average output power of the target slot and the average output power of the original slot. The nominal power step is equal to TPC_cmd times the *Step Size* (see also *Step Analysis* softkey on p. 4.22). TPC_cmd is derived from the TPC command settings transmitted to the UE *(Step Control)* according to the test algorithm *(TPC Mode)*; see section *Measurement Control (Power Configuration – Control)* on p. 4.18 ff.

Avg.	*Power Step Error* averaged over the (7 or 10, 14 or 20) power steps shown in sections A and B (if activated) of the lower diagram
Min./Max.	Extreme value (minimum or maximum, whichever has the larger absolute value) of the power steps shown in sections A and B (if activated) of the lower diagram
Section A	Accumulated power difference, i.e. the difference between the UE powers in the last and the first slot in section A of the upper diagram

Section B	Accumulated power difference, i.e. the difference between the UE powers in the last and the first slot in section B of the upper diagram

The *Section A* and *Section B* results provide the power step errors after 7 or 10 equal power steps; see *Table 4-4* on p. 4.27. The UE powers are measured according to the rules described above for the upper diagram.

Note: *In the TPC Modes* Off *and* Algorithm 1, *TPC_cmd can not be equal to zero. The corresponding output fields show invalid results ("---"). In the* Off *mode, where the intermediate power steps are generally not known in advance, the* Section A *and* Section B *results are also marked invalid.*

Additional Fields

The two output fields in the lower right part of the menu indicate the maximum output power *(Max. UE Power)* and the minimum output power *(Min. UE Power)* of the UE transmitter within the current measurement. Both values are averaged over a slot, not including the transient duration. This means that the output values correspond to the highest and the lowest power level indicated in the upper (UE Power) diagram.

Limit Check (Scalar Results)

In general, a red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Power Configuration* menu, see p. 4.25 ff. The standard specifies two different types of limits for inner loop TPC power steps:

- The *Step individual* limits are indicated in the lower diagram; see above. No limit is specified and no limit check is performed for the *Avg.* and *Min./Max.* values.
- The *Step Section A/B* limits hold for the *Section A* and *Section B* values. The limit check requires that the UE performs 7 or 10 equal power steps in each section (all TPC_cmd values equal to –1, 0, or +1; see *Table 4-4* on p. 4.27) and that the UE power does not exceed the *Max. Threshold* or the *Min. Threshold*. If one of these condition is not met, no limit check will be performed.

Remote control

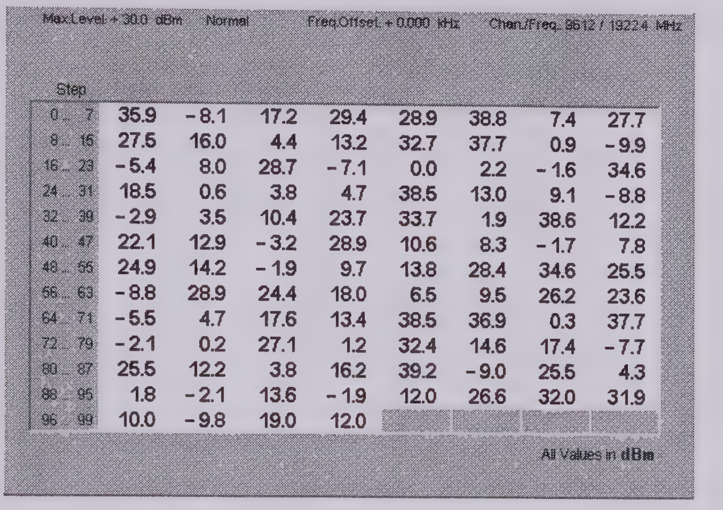
```
READ[:SCALar]:POWer:ILTPc:CURRent?
CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit?
FETCh[:SCALar]:POWer:ILTPc:CURRent?
SAMPle[:SCALar]:POWer:ILTPc:CURRent?
```

P/Slot Table

The measurement menu for the *P/Slot Table* application contains a parameter line and an output table.

Parameter line

Output table



Max.Level: + 30.0 dBm Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz

Step								
0 ... 7	35.9	- 8.1	17.2	29.4	28.9	38.8	7.4	27.7
8 ... 16	27.5	16.0	4.4	13.2	32.7	37.7	0.9	- 9.9
16 ... 23	- 5.4	8.0	28.7	- 7.1	0.0	2.2	- 1.6	34.6
24 ... 31	18.5	0.6	3.8	4.7	38.5	13.0	9.1	- 8.8
32 ... 39	- 2.9	3.5	10.4	23.7	33.7	1.9	38.6	12.2
40 ... 47	22.1	12.9	- 3.2	28.9	10.6	8.3	- 1.7	7.8
48 ... 55	24.9	14.2	- 1.9	9.7	13.8	28.4	34.6	25.5
56 ... 63	- 8.8	28.9	24.4	18.0	6.5	9.5	26.2	23.6
64 ... 71	- 5.5	4.7	17.6	13.4	38.5	36.9	0.3	37.7
72 ... 79	- 2.1	0.2	27.1	1.2	32.4	14.6	17.4	- 7.7
80 ... 87	25.5	12.2	3.8	16.2	39.2	- 9.0	25.5	4.3
88 ... 95	1.8	- 2.1	13.6	- 1.9	12.0	26.6	32.0	31.9
96 ... 99	10.0	- 9.8	19.0	12.0				

All Values in dBm

Fig. 4-5 Display of results (P/Slot Table)

Test settings The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu. The line is identical to the first parameter line of the test diagram in the *Maximum Power* application (see p. 4.10).

Results The *P/Slot Table* application measures the average UE transmitter output power in up to 100 slots which may be consecutive or separated by up to 14 intermediate (skipped) slots. The average is taken over a section of the slot or over the whole slot minus 25 μs at the beginning an at the end of the slot. The settings can be defined via hotkeys or in the *Control* tab of the *Power Configuration* menu; see p. 4.18 ff.

The table displays up to 100 results at the same time (see *Step Count* parameter in section *Measurement Control (Power Configuration – Control)* on p. 4.18 ff.). If the *Step Count* is set to a number < 100, the table shows *Off* for all results that are not measured. To be consistent with the numbering of the timeslots within a frame, the *Step* count in the table starts from 0. Note, however, that the slots to be measured are exclusively determined by the trigger conditions (see description of the *Step Delay* parameter on p. 4.24). No limit check is performed.

The CMU RF input path configuration must be set in accordance with the expected transmitter output power of the UE. In particular, the *P/Slot Table* shows invalid results ("–") for slots where the *Max. Level* is exceeded. The result in slot no. 0 is invalid if a negative trigger delay is set; see *Step Delay* parameter on p. 4.24.

Note 1: *The measurement results are obtained and displayed in real time. With a WCDMA frame period of 10 ms, the time to measure 100 consecutive slots is 1/15 seconds. In* Continuous *measurements (Repetition = Continuous), this results in a high update rate of the table.*

Note 2: *The P/Slot Table measurement requires an external trigger with a correct timing; see Fig. 4-8 on p. 4.25. Ideally the UE provides an external trigger signal that is correlated to its power steps to be measured. If no such external trigger is available the measurement can be performed with the internal frame trigger provided by the DL generator.*

Remote control

```
READ[:SCALar]:POWer:XSLOT:CURRent?
FETCh[:SCALar]:POWer:XSLOT:CURRent?
SAMPle[:SCALar]:POWer:XSLOT:CURRent?
```

Measurement Configurations (Power Configuration)

The popup menu *Power Configuration* contains two tabs to determine the parameters that control the power measurement and to define the tolerance limits.

The popup menu *Power Configuration* is activated by pressing the softkey at the top right in the graphical measurement menu *Power* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Power Configuration – Control)

The *Control* tab controls the power measurement by determining

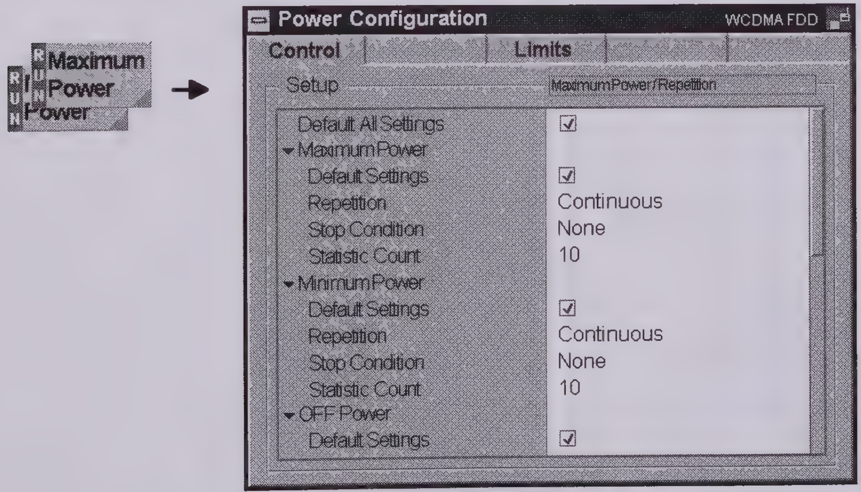
- The *Repetition* mode
- The *Stop Condition* for the measurement (not for *P/Slot Table* measurements)
- The number of slots/evaluation periods forming a statistics cycle *(Statistic Count,* not for *Inner Loop TPC* and *P/Slot Table* measurements)

The following settings configure the *Inner Loop TPC* measurement:

- Display of a *Grid* in the graphical diagrams
- Parameters defining the scope of the *Inner Loop TPC* measurement *(Profile Length, Step Size, Section B Analysis),* the power control algorithm *(TPC Mode),* and the type of results *(Step Analysis)*
- The TPC command sequence *(Step Control)*

The following settings configure the *P/Slot Table* measurement:

- The measurement time for a single measurement step *(Power Meas. Width)*
- The number of slots measured *(Step Count)*
- The number of slots elapsed between two consecutive measurements *(Step Width)*
- A delay time (number of slots) between the trigger time and the start of the measurement *(Step Delay)*



Setup: MaximumPower/Repetition

Default All Settings	☑
MaximumPower	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
MinimumPower	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
OFF Power	
Default Settings	☑

Fig. 4-6 Power Configuration – Control

The settings can be defined separately for the different applications of the *Power* measurement group.

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:POWer<Application>:CONTrol  ON | OFF etc.
```

Repetition

The *Repetition* field determines the repetition mode of the measurement:

Single Shot	Single shot measurement: the measurement is stopped after a statistics cycle (or after a stop condition is met, see below). A stopped measurement is indicated by the status display *HLT* in the *Power* softkey. Unless otherwise stated, a statistics cycle corresponds to the number of slots/evaluation periods set under *Statistic Count.*
Continuous	Continuous measurement: The CMU continues the measurement until it is terminated explicitly (or until the stop condition for the measurement is met, see below). The measurement results are valid after one statistics cycle; however, the measurement is continued, and the output is continuously updated. An ongoing measurement is indicated by the status display *RUN* in the *Power* softkey.

Single shot should be selected if only a single measurement result is required under fixed conditions. The continuous measurement is suitable for monitoring the evolution of a measured quantity in time, for example for adjustments.

Note: *In remote mode, the counting measurement (counting mode) is available as a further measurement mode with a defined number of measurement cycles to be performed, see chapter 6 of this manual.*

Remote control

```
CONFigure:POWer<Application>:CONTrol:REPetition
        CONTinuous | SINGleshot | 1 ... 10000,<StopCondition>,
                                      <Stepmode> etc.
```

Stop Condition

The *Stop Condition* field defines a stop condition for the measurement:

None	Continue measurement irrespective of the results of the limit check
On Limit Failure	Stop measurement as soon as the limit check fails (one of the tolerances is exceeded)

Remote control

```
CONFigure:POWer<Application>:CONTrol:REPetition
         <Repetition>,SONerror | NONE, <Stepmode> etc.
```

Statistic Count

The input field *Statistic Count* defines the number of slots that form a statistics cycle. The settings *1* and *OFF* (press *ON/OFF* key) are equivalent. A statistics cycle is equal to the duration of single shot measurements; see *Repetition Mode* above.

The *Inner Loop TPC* measurement always extends over a definite number of slots that is given by the *Profile Length,* the *TPC Mode*, and the *Section B Analysis* settings (see *Table 4-1* on p. 4.23). No additional *Statistic Count* needs to be set.

Remote control

```
CONFigure:POWer<Application>:CONTrol:STATistics
  1 ... 1000 | NONE
```

The following **Power Control** parameter is available for the *Maximum Power* and *Minimum Power* application.

TPC Qualifies whether the CMU commands the UE transmitter to transmit at its minimum or maximum power.

Automatic	After activating the *Maximum Power* or *Minimum Power* application, the CMU sends a constant sequence of Up or Down TPC bits to the UE so that it keeps transmitting at its maximum or minimum power. The Up or Down bits replace the previous TPC pattern.
Manual	After activating the *Maximum Power* or *Minimum Power* application, the downlink TPC pattern is not changed.

In both power control modes, it is possible to change the TPC pattern while the measurement is running, e.g. to test a drift of the UE transmitter. The changed pattern remains valid after the end of the *Maximum Power* or *Minimum Power* measurement (see also Table 4-23 on p. 4.174).

Remote control

```
CONFigure:POWer<Application>:CONTrol: TPControl
  AUTO | MANual
```

The following **TPC Settings** are valid for *Inner Loop TPC* measurements only.

Note: *Unless otherwise stated, all TPC parameters can be set independently. However, in view of the limit specifications, only a limited number of combinations really makes sense. These combinations are listed in Table 4-3 on p. 4.26 and in Table 4-4 on p. 4.27.*

Grid *Grid* switches the grid in the graphical test diagram on or off. By default, the grid is switched on.

Remote control
No command, display configuration only.

Profile Length The *Profile Length* parameter selects the number of power steps to be measured and displayed in each diagram section (section A and B, corresponding to the left and the right side of the graphical diagrams). Evaluation of a power step and of the *Power Step Error* involves the comparison of an original and a target slot, so the number of results in the upper *(UE Power)* diagram exceeds the number of results in the lower *(Power Step)* diagram by one (see also section *Inner Loop TPC* on p. 4.12 ff.).

7 Slots	The measurement extends over 8 slots for each diagram section. The upper *(UE Power)* diagram shows 8 slots; the lower diagram *(Power Step)* shows 7 steps per section.
10 Slots	The measurement extends over 11 slots for each diagram section. The upper *(UE Power)* diagram shows 11 slots; the lower diagram *(Power Step)* shows 10 steps per section.

The profile length settings are in accordance with the specified average TPC tolerances; see *Table 4-4* on p. 4.27.

Remote Control

```
CONFigure:POWer:ILTPc:CONTrol:TPCControl
<ProfileLength>, <StepSize>, <TPCMode>
```

Step Size

The *Step Size* parameter selects the relative power difference between two consecutive measured slots that the UE transmitter shall use. Step sizes of 1 dB, 2 dB, and 3 dB can be set.

The nominal inner loop *Power Step,* i.e. the difference between the average output power of the original slot and the average output power of the target slot, is equal to TPC_cmd times the *Step Size*. TPC_cmd is derived from the TPC command settings transmitted to the UE *(Step Control*, see below) according to the power control algorithm *(TPC Mode*, see below). The step size has an impact on the transmitter power control tolerances; see section *Tolerance Values (Power Configuration – Limits)* on p. 4.25 ff.

Note: *A step size of 0 dB is not available, however, constant UE power levels can be achieved by selecting power control* Algorithm 2*; see below.*

The Step Size doesn't have to be set in Signalling mode, where the value is taken from signalling; see Connection Control – BS Signal – TPC Settings. The maximum step size in Signalling mode is 2 dB.

Remote Control
`CONFigure:POWer:ILTPc:CONTrol:TPCControl`
`<ProfileLength>, <StepSize>, <TPCMode>`

TPC Mode

The *TPC Mode* parameter selects the inner loop Transmit Power Control algorithm for the UE transmitter.

Off	The UE is in a test mode where it performs power steps of ± *Step Size* (see above), but with a generally unknown TPC command sequence (see paragraph on *Step Control* on p. 4.23). 0-dB steps can not be evaluated correctly. The measurement can be performed in *Free Run* or *External* trigger mode. This TPC mode is particularly useful if the internal RF generator CMU-K66 is not available and if it is not intended or possible to set a TPC command sequence at the UE; see section *Test Scenarios for Inner Loop TPC* on p. 4.3 ff.
Algorithm 1	The UE is power-controlled according to *Algorithm 1 for processing TPC commands,* specified in standard 3GPP TS 25.214: One TPC command is received in each slot. If the received TPC command is equal to 1 (0), then the power control parameter TPC_cmd for that slot is +1 (–1). This implies that the UE transmitter output power changes after each slot.
Algorithm 2	The UE is power-controlled according to *Algorithm 2 for processing TPC commands,* specified in standard 3GPP TS 25.214: One TPC command is received in each slot. The slots are grouped into sets of 5 slots, aligned to the frame boundaries, so that there is no overlap between different sets of 5 slots. If the received TPC command is equal to 1 (0) in all 5 slots of a set, then the power control parameter TPC_cmd for the 5th slot is +1 (–1). Otherwise TPC_cmd for the 5th slot is 0. This implies that the UE transmitter output power only changes if the same TPC command is received in a complete set of 5 slots. *Algorithm 2* requires either a 10-slot *Profile Length* or an UE power that is constant over both diagram sections; see section *Test Scenarios for Inner Loop TPC* on p. 4.3 ff.

The sequence of TPC commands for *Algorithm 1* and *Algorithm 2* is defined in the *Step Control* section; see p. 4.23. Both algorithms require a trigger (external or internal; no *Free Run* measurement).

Note: *The TPC Mode doesn't have to be set in Signalling mode; where the value is taken from signalling; see Connection Control – BS Signal – TPC Settings..*

Remote Control

```
CONFigure:POWer:ILTPc:CONTrol:TPCControl
<ProfileLength>, <StepSize>, <TPCMode>
```

Step Analysis

The *Step Analysis* parameter selects the quantity to be displayed in the lower *(Power Step)* diagram:

Power Step	Difference of the UE power in two consecutive measured slots, $P(Slot_n) – P(Slot_{n–1})$.
Abs. Power Step	Absolute value of *Power Step*. The diagram is re-scaled to show only positive values, but with a higher resolution.
Power Step Error	Error of the *Power Step: Power Step* minus the *Step Size* commanded at the UE transmitter; see previous softkey.

The quantities in the output fields below the diagram and the limit check are not affected. For more information on the measurement results see section *Inner Loop TPC* on p. 4.12 ff.

Remote Control

```
CONFigure:POWer:ILTPc:CONTrol:SANalysis PST | PSTA | PSTE
```

Section B Analysis

The *Section B Analysis* parameter switches the measurement in the second profile length (see *Profile Length* softkey on p. 4.20) *On* or *Off*. Switching off section B accelerates the measurement and leaves the right half of the diagrams empty.

The TPC command sequence in sections A and B must be symmetric as explained in section *Inner Loop TPC* on p. 4.12 ff. The *Section B Analysis* setting is therefore not available if the *TPC Mode* is set to *Off* (measurement with unknown TPC command sequence, see above).

The CMU needs two consecutive trigger events to measure sections A and B, respectively. If section B is switched on and no second trigger event is received, only the section A results are available and the statistical results are based on section A alone.

The trigger condition must be observed in particular if the inner loop TPC is measured with a single TPC pattern transferred to the UE *(Internal* or *Signalling* trigger and *TPC Pattern Type = Single Pattern + All 0/Single Pattern + All 1/Single Pattern +Alternating;* see *Table 4-16* on p. *4.125*). In this case, pressing *Repeat Pattern* sends a single TPC pattern and simultaneously generates a trigger event. The section B results are available after *Repeat Pattern* is pressed for the second time. At the same time, all statistical results are updated.

The two symmetric sections A and B correspond to typical inner loop TPC measurement tasks:

Example 1: Set the UE to power control *Algorithm 1,* transmit a sequence of 10 TPC commands with the value 1, then transmit a sequence of 10 TPC commands with the value 0.

–> Activate *Section B Analysis.*

Example 2: Set the UE to power control *Algorithm 1,* transmit a sequence of 10 TPC commands with the value 1 while the UE operates at the maximum power threshold.

–> Deactivate *Section B Analysis.*

Remote Control
`CONFigure:POWer:ILTPc:CONTrol:BSECtion ON | OFF`

An overview of the *Inner Loop TPC* control parameters and the resulting measurement duration is given below.

Table 4-1 Inner Loop TPC measurement settings and duration

TPC Mode	Profile Length	Section B Analysis	Measurement length
Off	7 Slots	(always Off)	8 slots
Off	10 Slots	(always Off)	11 slots
Algorithm 1/2[1]	7 Slots	Off	8 slots
Algorithm 1/2	10 Slots	Off	11 slots
Algorithm 1/2[1]	7 Slots	On	2*8 slots 1 slot overlap, see Fig. 4-4
Algorithm 1/2	10 Slots	On	2*10 slots 1 slot overlap, see Fig. 4-4

Step Control – Section A

The *Step Control – Section A* defines the TPC command values for the 10 power steps that can be displayed in section A. If a 7-slot *Profile Length* is selected, the last three values are ignored. The TPC command values for section B are derived from the section A values according to the following condition: a TPC command 1 in slot no. n of section A implies a TPC command 0 in slot no. 10 – n in section B and vice versa.

The TPC commands for *Algorithm 1* and *Algorithm 2* are set independently. The values determine the TPC_cmd parameters and the UE transmitter output power steps between the measured slots; see paragraph on the *TPC Mode* above. The TPC command values are not used if *TPC Mode* is set to *Off.*

Remote Control
`CONFigure:POWer:ILTPc:CONTrol:TPCProfile:ALG<nr>`

---

[1] Algorithm 2 is compatible with a 7-slot profile length if no power steps occur over the whole measurement length.

The following settings are valid for ***P/Slot Table*** measurements only.

Power Meas. Width

The *Power Meas. Width* parameter selects the measurement time for a single measurement step. The power in a slot can be measured and averaged over ¼, ½ or 1 slot. A *Power Measurement Width* of 1 slot is available only if the *Step Width* (see below) is larger than 1 slot.

The measurement width is in accordance with the test specification for *Maximum Power, Minimum Power*, and *OFF Power* measurements: The measurement range is restricted to the useful part of the slot, excluding a guard period of 25 µs (96 chip periods) at the beginning and at the end of the slot. A measurement width of 1 slot therefore corresponds to 666.7 µs – 2*25 µs = 616.7 µs. The other two settings correspond to integer fractions of the total slot length of 666.7 µs (333.3 µs and 167.7 µs).

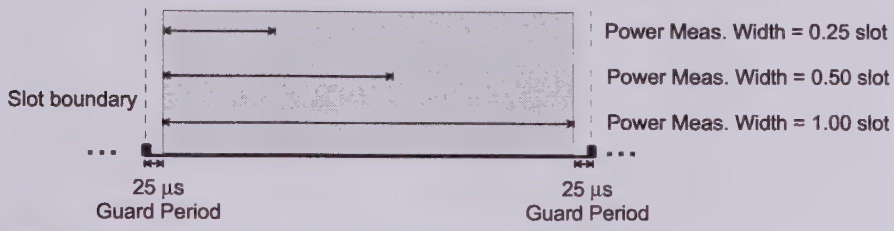

Power Meas. Width = 0.25 slot
Power Meas. Width = 0.50 slot
Power Meas. Width = 1.00 slot
Slot boundary
25 µs
Guard Period
25 µs
Guard Period

Fig. 4-7 Power measurement width

Remote Control
`CONFigure:POWer:XSLot:CONTrol:PMWidth <Width>`

Step Count

The *Step Count* parameter selects the number of slots measured.

Remote Control
`CONFigure:POWer:XSLot:CONTrol:SCOunt <StepCount>`

Step Width

The *Step Width* parameter selects the number of slots skipped between two consecutive measurements. With a step width of 1 (slot), each slot is measured.

The step width can be used to select particular slots where the UE is expected to change its ouput power. With a *Step Width* of 15 the CMU measures a particular slot in each frame: the measurement is frame-periodic.

Remote Control
`CONFigure:POWer:XSLot:CONTrol:SWIDth <StepWidth>`

Step Delay

The *Step Delay* parameter selects a delay time between the trigger time and the start of the measurement. *Step Delay* is defined in multiples of the *Step Width* (see above): a step delay of 2 at a step width of 5 means an actual delay of 2*5 slots = 10 slots. The *P/Slot Table* measurement must be performed with an external trigger fed in via pin no. 8 of the AUX 3 connector. The *Step Delay* is added to the trigger delay *(Slot Delay + Delay Offset)* defined in the *Trigger* tab of the *Connection Control* menu (see section *Trigger (Connection Control – Trigger)* on p. 6.136).

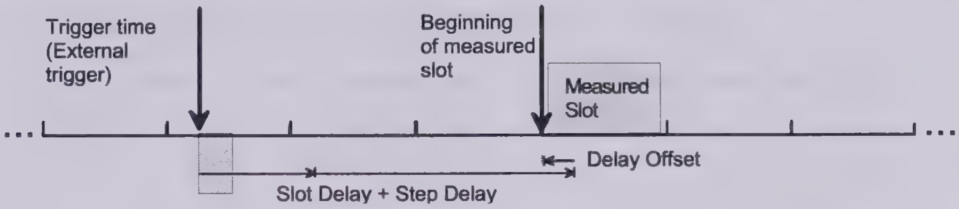


Fig. 4-8 Trigger delay and step delay for P/Slot Table measurement

The external trigger time ideally coincides with the slot boundary of the UL WCDMA signal. In this case *Slot Delay* and *Delay Offset* can be set to 0 and the *Step Delay* simply defines an offset between the trigger time and the measured slot. As explained above (see *Fig. 4-7*) the *P/Slot Table* measurement always starts 25 µs after the beginning of the measured slot.

Note: *In the P/Slot Table measurement with external trigger, the timing is exclusively determined by the external trigger time and the trigger delay parameters* (Slot Delay + Delay Offset). *In contrast to other measurements the CMU does not perform a correlation analysis to exactly pin down the beginning of the UL slot (see Fig. 4-60 on p. 4.129). The accuracy of the (corrected) trigger time must be «25 µs to ensure that the measurement range is actually confined to the central domain of the slot (see Fig. 4-7 on p.* 4.24*).*

If the sum of all trigger delay parameters is negative (i.e. Slot Delay = Step Delay = 0 *and* Delay Offset < 0 *so that the beginning of the measured slot precedes the real trigger time) the CMU skips the first slot (slot no. 0 in the result table) and shows an invalid "–" result. Otherwise, the measurement immediately starts at the corrected trigger time.*

Remote Control
`CONFigure:POWer:XSLot:CONTrol:SDELay <StepDelay>`

Tolerance Values (Power Configuration – Limits)

The *Limits* tab defines tolerance values for all peak and average UE output power results and for the power control steps that can be obtained in the *Power* measurement. For an explanation of the four applications *Maximum Power, Minimum Power*, *OFF Power,* and *Inner Loop TPC* refer to the beginning of section *Power Measurements* on p. 4.2.

Conformance requirements	In CDMA networks, power control is essential to ensure stable transmission and an efficient radio resource management within the system. Generally speaking, an output power of the UE transmitter that is too low decreases the coverage area while an excess output power may cause interference to other channels or systems. Both effects decrease the system capacity. The power tolerances are reported in standard 3GPP TS 25.101.
Maximum Power	WCDMA user equipment is divided into four power classes. In the standard, the maximum output power of the UE transmitter (averaged over the transmit slot) and its tolerance is defined according to the power class of the UE as shown in *Table 4-2 below.*

Table 4-2 Power classes and maximum output power

Power Class	Maximum Output Power (Rated Value)	Tolerance
1	+33 dBm	+1/–3 dB
2	+27 dBm	+1/–3 dB
3	+24 dBm	+1/–3 dB
4	+21 dBm	±2 dB

Minimum Power According to the standard, the minimum output power of the UE transmitter must be below –50 dBm.

OFF Power According to the standard, the *OFF Power* (i.e. the maximum output transmit power within the channel bandwidth when the UE transmitter is OFF) must be below –56 dBm.

Inner Loop TPC According to the standard, the Transmitter Power Control (TPC) tolerances are divided into two sets. The first set refers to individual power steps and depends on the step size. The values are quoted in *Table 4-3 below.* The values in *Table 4-3* hold in the UE transmitter output power range between the minimum power threshold of –50 dBm (see *Minimum Power* above) and the maximum power threshold depending on the power class (e.g. +21 dBm – 2 dB = +19 dBm for devices with power class 4; see *Table 4-2 above*). For UE transmitter output powers above the maximum threshold, the lower limits are not applicable. For UE transmitter output powers below the minimum threshold, the upper limits are not applicable.

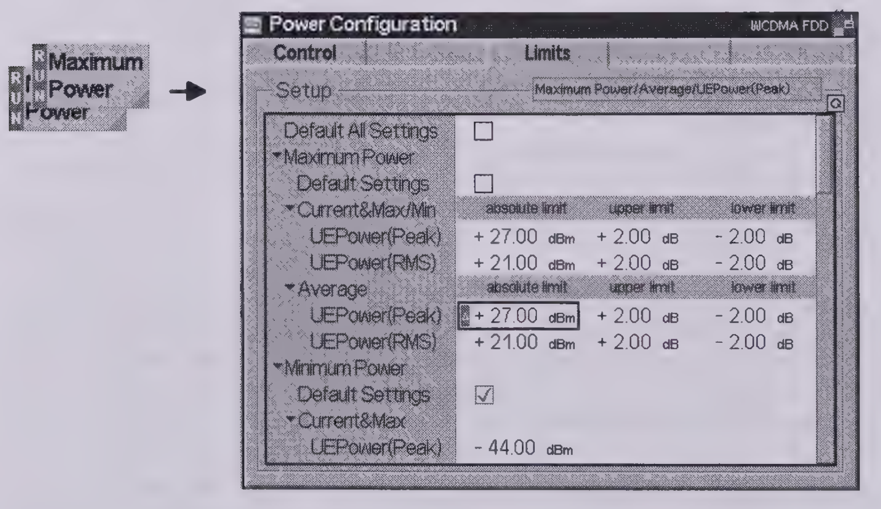
The second set of tolerances refers to either 7 or 10 equal TPC_cmd values. Again these average tolerance values depend on the step size; see *Table 4-4 below*. The values in *Table 4-4* hold in the UE transmitter output power range between the minimum and the maximum power threshold.

Table 4-3 Inner loop individual TPC tolerance

Step Size / dB	Max. Power Step Error / dB	TPC_cmd Values	Typical CMU Settings
0	± 0.5	TPC_cmd = 0	Arbitrary Step Size TPC Mode = Algorithm 2 Profile Length = 10 Steps (or 7 steps and constant UE power)
1	± 0.5	TPC_cmd = ± 1	Step Size = 1 dB TPC Mode = Algorithm 1 or 2 Profile Length = 10 Steps
2	± 1.0	TPC_cmd = ± 1	Step Size = 2 dB TPC Mode = Algorithm 1 (or 2) Profile Length = 10 Steps
3	± 1.5	TPC_cmd = ± 1	Step Size = 3 dB TPC Mode = Algorithm 1 (or 2) Profile Length = 7 Steps UE compressed mode power control

Table 4-4 Inner loop average TPC tolerance

Step Size / dB	**Max. Power Step Error after 7 Steps / dB**	**Max. Power Step Error after 10 Steps / dB**	**TPC_cmd Values**	**CMU Settings**
0	± 1.0	see below	TPC_cmd = 0	Arbitrary Step Size TPC Mode = Algorithm 2 Profile Length = 7 Steps and constant UE power
0	see above	± 1.0	TPC_cmd = 0	Arbitrary Step Size TPC Mode = Algorithm 2 Profile Length = 10 Steps and constant UE power
1	not applicable	± 2.0	TPC_cmd = ± 1	Step Size = 1 dB TPC Mode = Algorithm 1 Profile Length = 10 Steps with equal TPC commands
2	not applicable	± 4.0	TPC_cmd = ± 1	Step Size = 2 dB TPC Mode = Algorithm 1 Profile Length = 10 Steps with equal TPC commands
3	± 5.0	not applicable	TPC_cmd = ± 1	Step Size = 3 dB TPC Mode = Algorithm 1 Profile Length = 7 Steps with equal TPC commands UE compressed mode power control



Maximum Power/Average/UEPower(Peak)

	absolute limit	upper limit	lower limit
Default All Settings	☐		
Maximum Power			
Default Settings	☐		
Current&Max/Min			
UEPower(Peak)	+ 27.00 dBm	+ 2.00 dB	- 2.00 dB
UEPower(RMS)	+ 21.00 dBm	+ 2.00 dB	- 2.00 dB
Average			
UEPower(Peak)	+ 27.00 dBm	+ 2.00 dB	- 2.00 dB
UEPower(RMS)	+ 21.00 dBm	+ 2.00 dB	- 2.00 dB
Minimum Power			
Default Settings	☑		
Current&Max			
UEPower(Peak)	- 44.00 dBm		

Fig. 4-9 Power Configuration – Limits

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
`DEFault:POWer<Application>:LIMit ON | OFF etc.`

Maximum Power The table section *Maximum Power* defines upper and lower limits for the peak and average UE output power determined under the conditions of a *Maximum Power* measurement. Two different sets of limit values can be defined:

Current & Max./Min.	Common limits for the *Current,* the *Minimum and the Maximum* results (see description of output table in section *Measurement Results* on p. 4.10 ff.)
Average	Limits for the *Average* results

The tolerances for each result are specified by a rated maximum output power *(rated value,* in dBm) and an upper and a lower limit value *(upper limit, lower limit),* which is defined relative to the *rated value* (in dB). The limit check passes if the measurement result is in the range *[rated value + lower limit, rated value + upper limit]; see also Table 4-2* on p. 4.26.

Remote control

```
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:
  UPPer:VALue <Upper_Limit_Peak>,<Upper_Limit_RMS>
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:
  LOWer:VALue
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:
  RVALue
```

analogous commands for `AVERage` instead of `CMMax`.

Minimum Power/ OFF Power

The table sections *Minimum Power* and *OFF Power* define absolute upper limits for the peak and average UE output power determined under the conditions of a *Minimum Power* and *OFF Power* measurement. Two different limit values are provided for the *Current & Max.* and for *Average* results (in contrast to the *Maximum Power* measurement, the *Minimum* results don't make sense).

The limit check passes if the measurement result is below the specified limit.

Remote control

```
CONFigure:POWer:MINimum:CMAX:LIMit[:SCALar]:SYMMetric
  [:COMBined]:VALue
CONFigure:POWer:MINimum:AVERage:LIMit[:SCALar]:SYMMetric
  [:COMBined]:VALue
```

analogous commands for `OFF` instead of `MINimum`.

Inner Loop TPC

The table section *Inner Loop TPC* defines symmetric limits for the UE output power steps that the UE transmitter uses for inner loop power control and a minimum and maximum threshold limiting the power control range; see explanations at the beginning of this section. The *Limit Info* diagram visualizes how the limit check is handled in above *Max. Threshold*, in the power control range and below *Min. Threshold.*

Max. Threshold	Upper limit of the power control range. By default, *Max. Threshold* is defined as the lowest permissible output power for the UE power class (e.g. +21 dBm – 2 dB = +19 dBm for devices with power class 4; see *Table 4-2 above*). In the output power range above *Max. Threshold,* the lower individual power step limits *(Step individual)* in *Table 4-3* and all average power step limits in *Table 4-4* are ignored.
Min. Threshold	Lower limit of the power control range. By default, *Min. Threshold* is defined as –50 dBm; see *Minimum Power* above). In the output power range below *Min. Threshold,* the upper individual power step limits *(Step Section A/B)* in *Table 4-3* and all average power step limits in *Table 4-4* are ignored.
Step individual	Symmetric power step limits for individual power steps; see *Table 4-3 above.* The individual limits and limit check results are indicated in the lower diagram. Beyond the *Min. Threshold* and

	the *Max. Threshold,* the limits are no longer evaluated symmetrically.
Step Section A/B	Symmetric power step limits for either 7 or 10 equal TPC_cmd values; see *Table 4-4 above*. The section A/B limit check results are indicated in the *Section A* and *Section B* output fields below the diagrams. These limits are not valid beyond the *Min. Threshold* and the *Max. Threshold*.

Remote control

```
CONFigure:POWer:ILTPc:THReshold:CURRent:LIMit[:SCALar]
  :ASYMmetric[:COMBined]:VALue
  <MaxThreshold_Limit_Current>, <MinThreshold_Limit_Current>
CONFigure:POWer:ILTPc:STEP:CURRent:LIMit[:SCALar]
  :SYMMetric[:COMBined]:VALue
```

Modulation Measurements

The menu group *Modulation* measures the modulation accuracy of the RF signal from the UE. Modulation accuracy is the ability of the UE transmitter to generate an ideal QPSK-modulated signal. Several graphical measurement menus are provided to display the measurement results. The popup menu *Modulation Configuration* is used for configuration of the measurements.

The characteristics of the modulation measurement, the measured quantities and the measurement menus depend largely on the signal configuration selected by means of the *Application – QPSK WCDMA* hotkey in the *Modulation* measurement menu:

- The *QPSK*[2] mode is used to measure the QPSK modulated signal with a chip rate of 3.84 Mcps. Examples of valid signals are a single DPCCH signal, a single DPDCH signal or a combination of a DPCCH with one DPDCH (see Fig. 4-12 on p. 4.33) and equal gain factors: The DPCCH and the DPDCH are summed to a complex-valued signal with a constellation diagram that is still QPSK-like). The channelization code, scrambling code and the symbol rate are irrelevant to the measurement. This mode is faster than the *WCDMA* mode and is useful to adjust the modulator of the UE transmitter.
- The *WCDMA* mode is used to measure the WCDMA signal, i.e. a 3GPP standard uplink signal with a chip rate of 3.84 Mcps and channel coding.

For the sake of clarity, the two signal configurations are explained separately throughout the remainder of the *Modulation Measurements* section.

Measurement of Modulation Parameters

The purpose of this section is to illustrate the meaning of the physical parameters determined in the *Modulation* measurement. For a discussion of the different averaging procedures involved please refer to Chapter 3.

Definition of measured quantities:

According to the Terminal Conformance Specification TS 34.121, the quality of the modulated uplink WCDMA signal is primarily assessed by its *Error Vector Magnitude (EVM)* and *Peak Code Domain Error (PCDE)*. The EVM quantifies the modulation quality of the composite signal, the PCDE quantifies the modulation quality of the individual code channels in a considered code domain. The combination of both parameters ensures that the entire WCDMA signal as well as all code channels satisfy the requirements of the conformance specification.

The measurement of both parameters is based on a comparison between the modulation vector Z in the I/Q-plane, measured over the complete slot or a fraction of it (termed the *Measurement Length* in the CMU), and an ideal, calculated reference signal R'; see *10 below*. The modulation parameters of the conformance specification are defined as follows:

Error Vector Magnitude, EVM (RMS)	RMS value of the error vector E = R' – Z divided by the RMS value of the reference signal R', expressed in percent.
PCDE	Maximum Code Domain Error for all codes in a considered code domain at a specific spreading factor. The Code Domain Error for every code corresponds to the projection of the EVM onto that code. The PCDE is expressed in dB.

The CMU provides the not only the EVM (RMS) value but also the (positive definite) normalized error vector EVM = E/R' over the whole measurement range. In addition to this time-dependent EVM, the comparison of Z and R' yields two additional non-redundant quantities; see *10 below*:

Phase Error	Difference in phase between the measured and the ideal modulated signal vector.
Magnitude Error	Difference between the magnitudes of the measured and the ideal modulated signal vector.

The EVM, phase error and magnitude error can be displayed in three separate graphical measurement menus. In addition, the CMU provides a statistical evaluation of all three quantities.

---

[2] The modulation scheme used in the uplink is actually a modified QPSK scheme that is often referred to as HPSK modulation (Hybrid Phase Shift Keying).

The frequency accuracy is assessed by means of the following parameter:

Carrier Frequency Error	Difference of the measured UE modulated carrier frequency from the expected (nominal) frequency.

In addition to the previous parameters, specified in standard TS 34.121, the CMU provides the following results:

I/Q Origin Offset	Origin offset in the I/Q constellation diagram reflecting a DC offset in the baseband signal (see *Fig. 4-11* on page 4.32 and *Equation 4-1*). The origin offset corresponds to a RF carrier feedthrough in spectral representation.
I/Q Imbalance	Amplitude difference between the in-phase (I) to the quadrature (Q) components of the measured signal, normalized and logarithmized (see *Fig. 4-11* on page 4.32 and *Equation 4-2*). The I/Q imbalance corresponds to an unwanted signal in the opposite sideband in spectral representation.
Waveform Quality	Normalized correlated power between the actual and the ideal waveform.

A limit check is provided for all three error curves and all scalar results.

In annex E of standard TS 34.121, the different steps to obtain the *Modulation* parameters are outlined as follows:

1. **Acquire the signal Z and calculate the reference signal R**

The actual modulation vector of the output signal of the Node B under test is measured over a complete slot slot and stored as Z, using a matched filter (an RRC filter with a roll-off $\alpha = 0.22$ and a bandwidth equal to the chip rate). A reference signal R with variable timing, RF carrier frequency f_{Carr} and power (gain factors; see *Fig. 4-12* on p. 4.33 and *Fig. 4-13* on p. 4.34), is constructed mathematically and filtered by the same matched filter.

2. **Derive the Code Domain Power and Frequency Error**

The timing, carrier frequency f_{Carr} and power of the reference signal R is varied in order to achieve best fit with the measured signal Z, i.e. to minimize the RMS value of the difference Z – R. This yields the measured values of the *Frequency Error*, the *Code Domain Power* (see section *Code Domain Power Measurements* on p. 4.78 ff.) and the varied reference signal R'.

3. **Calculate the EVM, Phase Error and Magnitude Error as a function of time**

The error vector $E = Z - R'$ is calculated as an array at each sample in the measurement interval. From E and Z the following arrays can be calculated:

$\lvert E \rvert = \lvert Z - R' \rvert$	Magnitude of the error vector, calculated at each sample in the measurement interval.
$\Delta\varphi$	Phase error
$\lvert Z \rvert - \lvert R' \rvert$	Magnitude error

The *Modulation* measurement diagrams show the relative magnitude error and the relative EVM, i.e. the quantities defined above divided by the magnitude of the ideal modulation vector $\lvert R' \rvert$.

Note: *The test functionality of the CMU is beyond the requirements of the standard where nothing regarding the phase error and magnitude error is specified.*

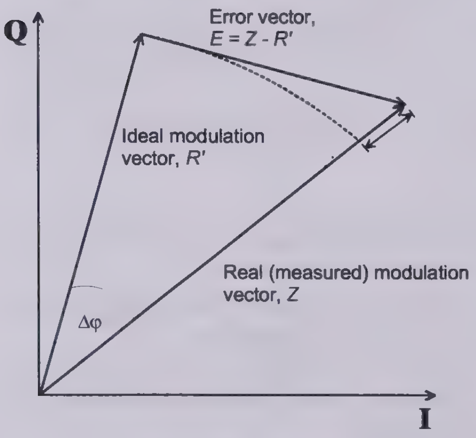

Q
Error vector,
E = Z - R'
Ideal modulation vector, R'
Real (measured) modulation vector, Z
Δφ
I

Fig. 4-10 Modulation errors in the I/Q vector diagram

4. Calculate the EVM (RMS) and PCDE

The EVM (RMS) is calculated as the ratio of the RMS value of E to the RMS value of R' in percent, i.e.

$$EVM = RMS(E) / RMS(R') * 100\%$$

The Peak Code Domain Error (PCDE) is calculated as follows:

The error vector $E = Z - R'$ is descrambled and projected onto all code channels of a specific spreading factor SF. For each of the resulting projected error vectors E_k ($k = 0$ to $SF - 1$), the RMS value is calculated. The PCDE is calculated as the ratio of the maximum of the RMS values of E_k to the RMS value of R' in dB, i.e.

$$PCDE = 20 * \log [\max_k RMS(E_k) / RMS(R')] \text{ dB}$$

In addition to the previous parameters, CMU provides the Origin Offset, the I/Q Imbalance and the Waveform Quality:

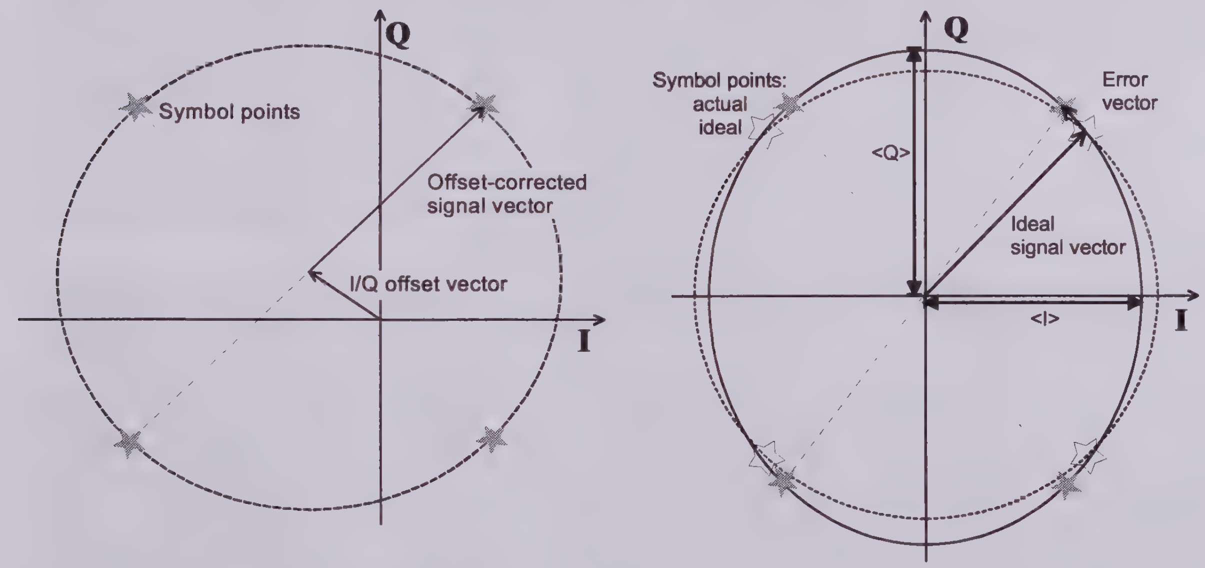


Fig. 4-11 Modulation errors in the I/Q constellation diagram

Origin offset

Fig. 4-11 is an idealized representation of the modulation errors where the effects of a pure origin offset (left diagram) and of a pure I/Q imbalance (right diagram) are completely disentangled. The I/Q offset in dB is the logarithmic ratio of the I/Q offset vector (i.e. the estimated DC-offset of the measured signal) to the average offset-corrected signal vector:

$$\text{Origin Offset} = 20\log\frac{|\text{I/Q offset vector}|}{|\text{Offset-corrected signal vector}|_{\text{RMS}}} \qquad \text{(Equation 4-1).}$$

In *Equation 4-1*, | Offset - corrected signal vector $|_{\text{RMS}}$ denotes the magnitude of the offset-corrected signal vector that is RMS-averaged over all samples.

Analysis Mode

In the *UE Code* tab of the *Connection Control* menu (see section *UE Code* on p. 4.106 ff.), two alternative *Analysis Modes* can be set:

In the analysis *With Origin Offset*, which conforms to 3GPP specifications, the modulation vectors R and Z in *Fig. 4-16* are measured from the origin of the I/Q plane, so the results for the EVM, phase error and magnitude error include a possible origin offset.

In the analysis *Without Origin Offset*, the modulation vectors R and Z in *Fig. 4-16* are measured from the coordinates of the I/Q offset vector, so the origin offset is subtracted out in the EVM, phase error and magnitude error results.

Note: *The I/Q imbalance is always calculated without origin offset regardless of the* Analysis Mode *set (see Fig. 4-11). Conversely, the waveform quality is always calculated with origin offset.*

I/Q imbalance

The I/Q imbalance in dB is equal to the difference between the estimated I and Q amplitudes of the measured signal, which are normalized and logarithmized as follows:

$$\text{I/Q Imbalance} = 20\log\frac{|<\mathrm{I}> - <\mathrm{Q}>|}{|<\mathrm{I}> + <\mathrm{Q}>|} \quad \text{(Equation 4-2).}$$

Waveform quality

The waveform quality or ρ factor is a measure for the modulation accuracy and corresponds to the normalized correlated power between the actual waveform and the ideal waveform sampled at the constellation points. According to standard TIA/EIA/SP-4583, it is defined as:

$$\text{Waveform Quality} = \frac{|\sum_k R'_k Z_k^*|^2}{\sum_k |R'_k|^2 \sum_k |Z_k|^2} \quad \text{(Equation 4-3),}$$

where R'_k is the k^{th} sample of the ideal signal, Z_k is the k^{th} sample of the measured signal (both in complex representation) and the sums run over all samples. For an ideal transmitter ($Z_k = R_k$ for all k), the waveform quality is equal to 1. For real transmitters, the waveform quality is a positive real number smaller than 1.

Uplink WCDMA Signal

As a prerequisite to the WCDMA modulation measurement, the CMU commands the UE to transmit an uplink WCDMA signal. Its properties are as defined in 3G TS 25.213, *Spreading and modulation (FDD):*

The WCDMA signal is composed of one control channel (DPCCH) and n data channels (DPDCH), where n is between 0 and 6. The symbols of all channels are first spread to the chip rate by the channelization codes c, weighted by gain factors β and summed to form a complex-valued stream of chips. This complex-valued signal is then scrambled by a long or short scrambling code and finally QPSK modulated. For a WCDMA signal consisting of the DPCCH plus one DPDCH, the different spreading and modulation stages are shown in see *Fig. 4-12* below.

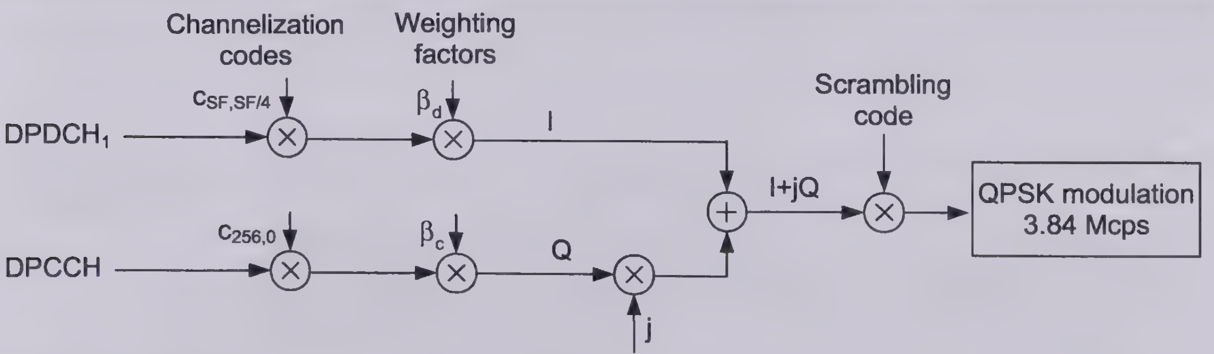


Fig. 4-12 Uplink WCDMA signal with up to 1 data channel

The **channelization codes** are defined in terms of the spreading factors SF and an index k ranging from 0 to SF – 1. The spreading factor relates the chip rate of the total WCDMA signal to the symbol rate of the individual channel: SF (Channel) x Symbol rate (Channel) = 3.84 Mcps.

According to the standard, the DPCCH is always spread with code $c_{256,0}$, corresponding to a symbol rate of 15 kbps. In the signal configuration of *Fig. 4-12,* where one DPDCH is transmitted, spreading factors of 4, 8, 16, 32, 64, 128 or 256 may be used, and the corresponding DPDCH channelization codes are $c_{SF,SF/4}$. The CMU sets the spreading factor implicitly as the symbol rate for the first DPDCH can be selected. With several DPDCHs, $DPDCH_n$ is spread by $c_{4,k}$, where k = 1 if n ∈ {1, 2}, k = 3 if n ∈ {3, 4}, and k = 2 if n ∈ {5, 6}. The corresponding signal configuration is shown in *Fig. 4-13* below.

The CMU is able to analyze standard WCDMA signals with an arbitrary number of DPDCHs and arbitrary channelization codes.

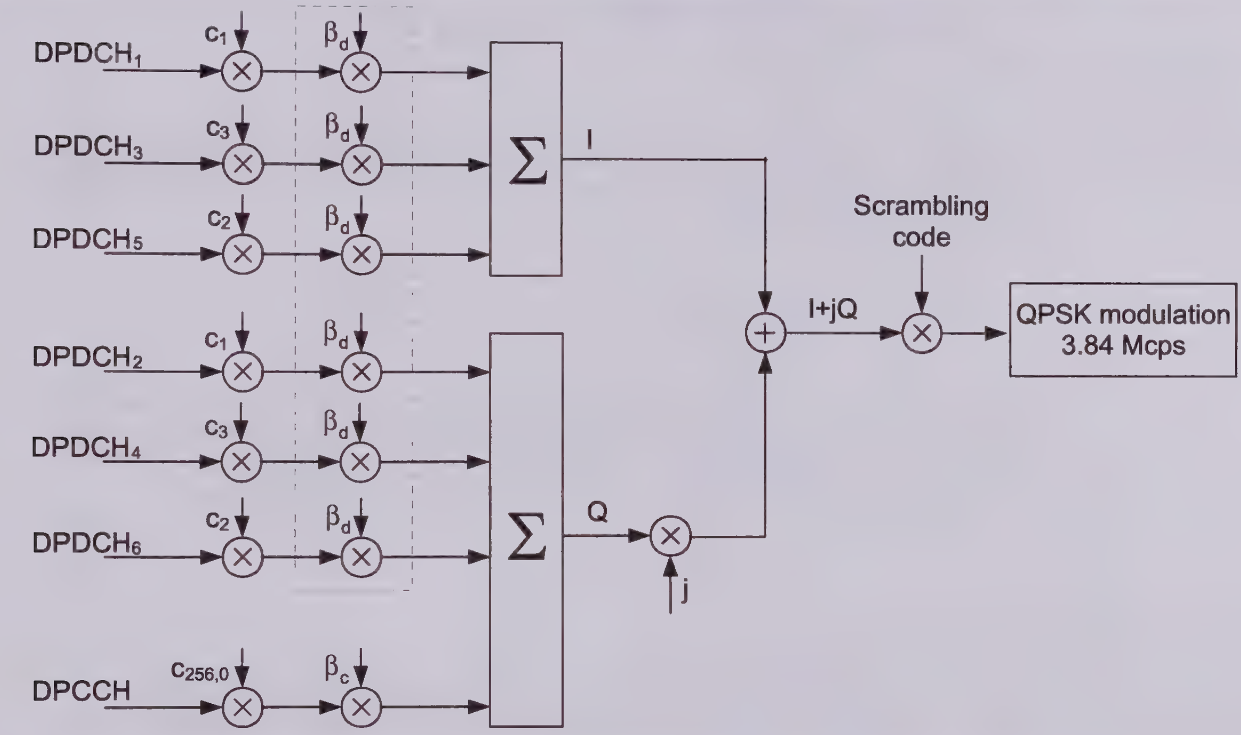


Fig. 4-13 Uplink WCDMA signal with up to 6 data channels

The **weighting factors** are equal for all transmitted DPDCHs, so they essentially determine the DPCCH/DPDCH power ratio.

The **scrambling code** is a complex-valued sequence of either long or short type that is distinguished by its scrambling code number. The CMU supports long codes only.

Measurement Menu (Modulation – QPSK)

If the QPSK signal configuration is selected (see *Application* softkey in section *Test Settings* on page 4.35 ff.), the graphical measurement menu *Modulation* displays quantities characterizing the modulation accuracy of a single QPSK-modulated signal with a chip rate of 3.84 Mcps.

- The measurement control softkey *Overview QPSK* (which changes to *EVM QPSK, Magn. Error QPSK, Phase Error QPSK*, or *I/Q Analyz. QPSK* if the corresponding application is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the measurement control softkey define the scope of the Modulation measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.5.

The measurement menu *Modulation* can be accessed from any other measurement menu of the WCDMA UE function group using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

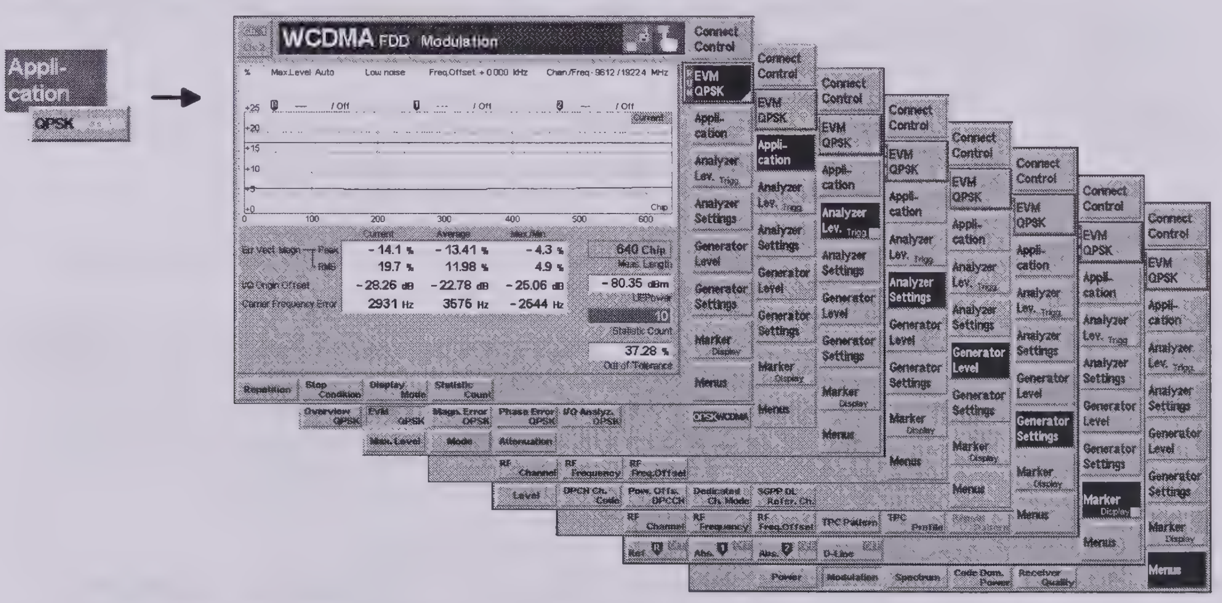

Application
QPSK
WCDMA FDD Modulation
Current
Average
Max./Min.
Err.Vect.Magn. Peak
RMS
I/Q Origin Offset
Carrier Frequency Error
- 14.1 % - 13.41 % - 4.3 %
19.7 % 11.98 % 4.9 %
- 28.26 dB - 22.78 dB - 25.06 dB
2931 Hz 3576 Hz - 2644 Hz
640 Chip Meas. Length
- 80.35 dBm UEPower
10 Statistic Count
37.28 % Out of Tolerance
Connect Control
EVM QPSK
Application
Analyzer Lev. Trigg.
Analyzer Settings
Generator Level
Generator Settings
Marker Display
Menus
Repetition
Stop Condition
Display Mode
Statistic Count
Overview QPSK
EVM QPSK
Magn. Error QPSK
Phase Error QPSK
I/Q Analyz. QPSK
Max. Level
Mode
Attenuation
RF Channel
RF Frequency
RF Freq.Offset
Level
DPCH Ch. Code
Pow. Offs. DPCCH
Dedicated Ch. Mode
3GPP DL Refer. Ch.
TPC Pattern
TPC Profile
Ref.
Abs.
D-Line
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

Fig. 4-14 Measurement menu Modulation – EVM QPSK

Test Settings

The *Analyzer Level, Analyzer Settings* and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.6). The following softkeys and hotkeys differ from the *Power* measurement:

Overview QPSK

The *Overview QPSK* softkey controls the QPSK modulation measurement and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Modulation* measurement, however, a running measurement is restarted.

Remote control
`INITiate:MODulation:OVERview:QPSK`

`ABORt:MODulation:OVERview:QPSK`
`STOP:MODulation:OVERview:QPSK`
`CONTinue:MODulation:OVERview:QPSK` etc.

Measurement configuration

Pressing the *Overview QPSK* softkey twice opens the popup menu *Modulation Configuration* (see page 4.53 ff.). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated to the *Overview QPSK* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test settings* on page 4.6); they are identical with the parameters set in the *Control t*ab of the *Modulation Configuration* menu (see page 4.53 ff.).

Application

The *Application* softkey selects the measurement application and the signal configuration.

The alternative diagrams (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.53 ff.).

Overview QPSK

The *Overview QPSK* hotkey selects all scalar modulation results to be displayed. For an explanation of the measured quantities see section *Measurement of Modulation Parameters* on page 4.30.

Remote control
No explicit switchover command. All *Overview QPSK* measurements are identified by the 3rd/4th level keywords `...OVERview:QPSK...`

EVM QPSK

The *EVM QPSK* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the UE and the ideal signal vector at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.30. The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *EVM QPSK* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:QPSK...`

Magn. Err. QPSK

The *Magnitude Error QPSK* hotkey selects the magnitude error of the modulation vector to be displayed.

The magnitude error is the difference in magnitude between the measured signal from the UE and an ideal signal waveform at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.30. The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *Magn. Error QPSK* measurements are identified by the 3rd/4th level keywords `...MERRor:QPSK...`

Phase Err. QPSK

The *Phase Error QPSK* hotkey selects the phase error of the modulation vector to be displayed.

The phase error is the difference in phase between the measured signal from the UE and an ideal signal waveform at the symbol points (in deg), see explanation in section *Measurement of Modulation Parameters* on page 4.30.

Remote control
No explicit switchover command. All *Phase Error QPSK* measurements are identified by the 3rd/4th level keywords `...PERRor:QPSK...`

I/Q Analyz. QPSK

The *I/Q Analyz. QPSK* hotkey selects the diagrams to display the modulation vector in the I/Q plane (constellation diagram, vector diagram) and the I and Q amplitude vs. time *(I Phase, Q Phase, I Phase & Q Phase).*

The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.53 ff.

Remote control
No explicit switchover command. All *I/Q Analyz QPSK* measurements are identified by the 3rd/4th level keywords `...IQANalyzer:QPSK...`

QPSK WCDMA

The *QPSK WCDMA* hotkey toggles between *QPSK* mode and *WCDMA* signal configuration.

The current signal configuration is marked in inverse video (white typeface on a dark background). Selecting another signal configuration also changes the *Modulation* measurement menu; see section *Measurement Menu (Modulation – WCDMA)* on page 4.45 ff.

Remote control
QPSK and WCDMA signals are identified by the keywords `:QPSK` and `:WCDMa:DPCH` in the command headers, respectively.

Marker Display

The *Marker/Display* softkey positions up to 3 markers and a D-line in the test diagram and displays their values.

If pressed once again, the selected *Marker/Display* softkey changes to the *Display/Marker* softkey, see below. Both softkeys are not available in the *Overview* application where no measurement curve is displayed.

Markers	The markers are graphical tools for marking points on the measurement curve and for numerical output of measured values. The measurement menu *Modulation* provides a reference marker and two further markers that permit to measure distances (delta marker 1 and 2). The coordinates of the three markers are indicated in the format Ordinate value (EVM or magnitude error or phase error)/abscissa value (time) in a parameter line above the test diagram. The position of the reference marker is expressed in absolute units (EVM and magnitude error in percent, phase error in deg, and time/abscissa value in chip periods), the delta marker can be defined by absolute or relative values (e.g. time differences from the reference marker).
D-line	The D-line is a horizontal line that can be positioned to mark or read out an arbitrary level in the test diagram.

Ref R

The hotkey *Ref. R* switches the reference marker on or off (use the *ON/OFF* key).

The reference marker is represented by the symbol R in the test diagram. The marker position (abscissa) is defined in the input field *Ref. Marker R*. The marker is switched off in the default setting *(Off)*. The marker value is given by the measurement curve at the marker position.

The position of all markers can be varied using the roll-key.

Remote control
No command, screen configuration only.

Rel 1

The *Rel. 1* hotkey switches the delta marker 1 on or off (use the *ON/OFF* key).

The delta marker 1 is represented by the symbol 1 in the test diagram. The marker position (abscissa) is defined in the input field *Rel. Marker 1*. The marker is switched off in the default setting *(Off)*. The marker value is given by the measurement curve at the marker position.

The toggle switch *Rel 1 Config* pops up when the hotkey is pressed for the second time. It defines whether the position of delta marker 1 is measured and indicated in absolute units or relative to the reference marker.

Remote control
No command, screen configuration only.

Rel 2

The *Rel. 2* hotkey switches the delta marker 2 on or off (use the *ON/OFF* key). Functions and remote control are analogous to delta marker 1.

D-Line

The *D-Line* hotkey switches the D-line in the test diagram on or off.

The D-line is a horizontal, colored auxiliary line in the test diagram and is used for marking an ordinate value or for measuring differences. The ordinate value is determined in the input field *D-Line* and indicated on the D-line. The permissible value range is the diagram area, the default setting is *Off.*

Remote control
No command, screen configuration only.

Display
Marker

The *Display/Marker* softkey selects the x-axis range for the graphical display. It is activated by pressing the *Marker/Display* softkey twice. If pressed once again, the selected *Display/Marker* softkey changes back to the *Marker/Display* softkey, see above.

All *Display* settings are also provided in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.53 ff.

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (curves plotted as a function of time)

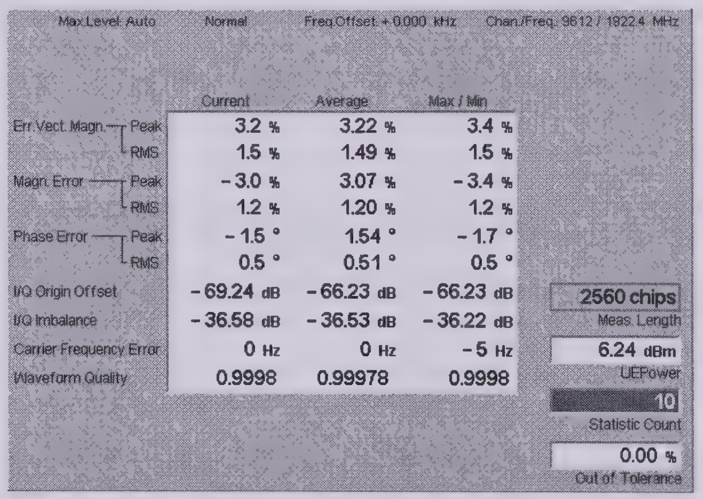
The measurement menu for the *Overview* application shows all scalar results but no curve. The measurement menus for the *EVM, Magn. Err.* and *Phase Err.* applications are analogous to each other and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity. The *I/Q Analyzer* application provides a graphical analysis of the the modulation vector in the I/Q plane.

Scalar Results (Overview)

The measurement menu for the application *Overview QPSK* shows all scalar results. Most of the values are displayed in tabular form:

Parameter line

Output table
and additional fields



Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz

		Current	Average	Max / Min
Err.Vect. Magn.	Peak	3.2 %	3.22 %	3.4 %
	RMS	1.5 %	1.49 %	1.5 %
Magn. Error	Peak	- 3.0 %	3.07 %	- 3.4 %
	RMS	1.2 %	1.20 %	1.2 %
Phase Error	Peak	- 1.5 °	1.54 °	- 1.7 °
	RMS	0.5 °	0.51 °	0.5 °
I/Q Origin Offset		- 69.24 dB	- 66.23 dB	- 66.23 dB
I/Q Imbalance		- 36.58 dB	- 36.53 dB	- 36.22 dB
Carrier Frequency Error		0 Hz	0 Hz	- 5 Hz
Waveform Quality		0.9998	0.99978	0.9998

Meas. Length: 2560 chips

UEPower: 6.24 dBm

Statistic Count: 10

Out of Tolerance: 0.00 %

Fig. 4-15 Display of results (Modulation – Overview QPSK)

Parameter line The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output table The scalar values in the output table are explained in section *Measurement of Modulation Parameters* on p. 4.30 ff. They are calculated for all evaluation periods measured and displayed in the *Current* column. From the *Current* results the average referenced to a statistics cycle (*Average,* see averaging rules in Chapter 3, section *General Settings)* and the extreme value over all evaluation periods measured during the ongoing measurement *(Max/Min)* is calculated. Peak and RMS values are taken over the whole *Meas. Length,* see below. For a discussion of the different averaging rules used refer to Chapter 3.

Limit Check A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see section *Tolerance Values (Modulation Configuration – Limits)* on p. 4.56.

Additional fields Four output fields to the right of output table indicate the following results and settings:

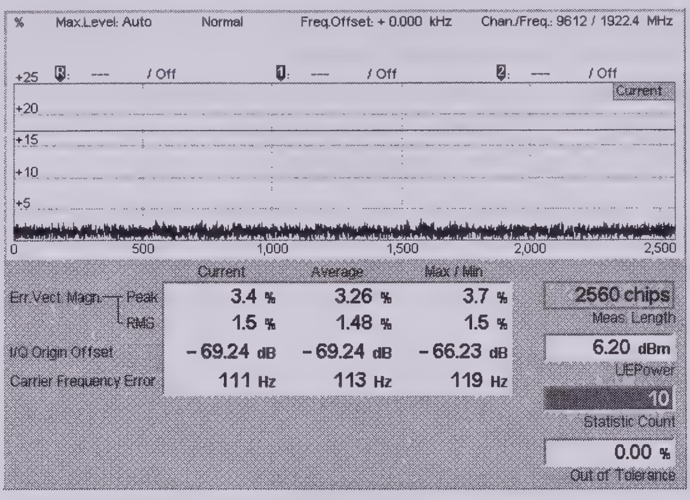
Meas. Length	Number of chips measured and used to calculate average and peak values as set in the *Control* tab of the *Modulation Configuration* menu, see section *Measurement Control (Modulation Configuration – Control)* on p. 4.53.
UE Power	Average power in the current evaluation period (irrespective of the display mode selected and of the curve in the other QPSK applications).
Statistic Count	Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Out of Tolerance	Percentage of evaluation periods where the tolerances are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

```
READ[:SCALar]:MODulation:OVERview:QPSK? etc.
CALCulate[:SCALar]:MODulation:OVERview:QPSK:
  MATChing:LIMit?
```

Test Diagrams (EVM, Phase Error, Magn. Error)

The graphical measurement menus for the three applications *EVM QPSK*, *Magn. Error QPSK*, and *Phase Error QPSK* are analogous. The results are indicated in two parameter lines, the test diagram, and a tabular overview below:



Parameter lines

Test diagram

Output fields

and table

% Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz

R: --- / Off 1: --- / Off 2: --- / Off

		Current	Average	Max / Min
Err.Vect.Magn.	Peak	3.4 %	3.26 %	3.7 %
	RMS	1.5 %	1.48 %	1.5 %
I/Q Origin Offset		– 69.24 dB	– 69.24 dB	– 66.23 dB
Carrier Frequency Error		111 Hz	113 Hz	119 Hz

Meas. Length	2560 chips
UEPower	6.20 dBm
Statistic Count	10
Out of Tolerance	0.00 %

Fig. 4-16 Display of results (Modulation – EVM / Phase Error / Magn. Error QPSK)

Settings/ Scalar results Scalar measurement results and settings are indicated in the two parameter lines above the test diagram and in the output table below.

1st parameter line The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

2nd parameter line The second parameter line contains the following marker values:

R	Measurement result and time of reference marker
1	Measurement result and time of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and time of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Output table/ Additional fields The output table shows a subset of the results provided in the *Overview* application; see section *Scalar Results (Overview)* on page 4.39 ff. The four output fields to the right of the output table are also provided in the *Overview* application.

Measurement curves (arrays) The continuous curve in the test diagram shows the measured quantity as a function of time (in chip periods). The curve depends on the display mode *(Current, Max./Min., Average)* that can be set in the *Control* tab of the configuration menu (see section *Measurement Control (Modulation Configuration – Control)* on p. 4.53 f). The display mode is indicated in the upper right corner of the diagram.

The measurement curve extends over the *Meas. Length* indicated in the output field below, one slot comprising 2560 chips. The curve is derived from equidistant measurement points with a 1-chip spacing. The y-axis range is fixed for any of the three measured quantities (applications):

0 % to +25 %	for the error vector magnitude
–20 % to +20 %	for the magnitude error
–20 deg to +20 deg	for the phase error

The red, horizontal lines in the test diagram mark the tolerance range of the measured quantities as set in the *Limits* tab of the *Modulation Configuration* menu (see p. 4.56 ff.).

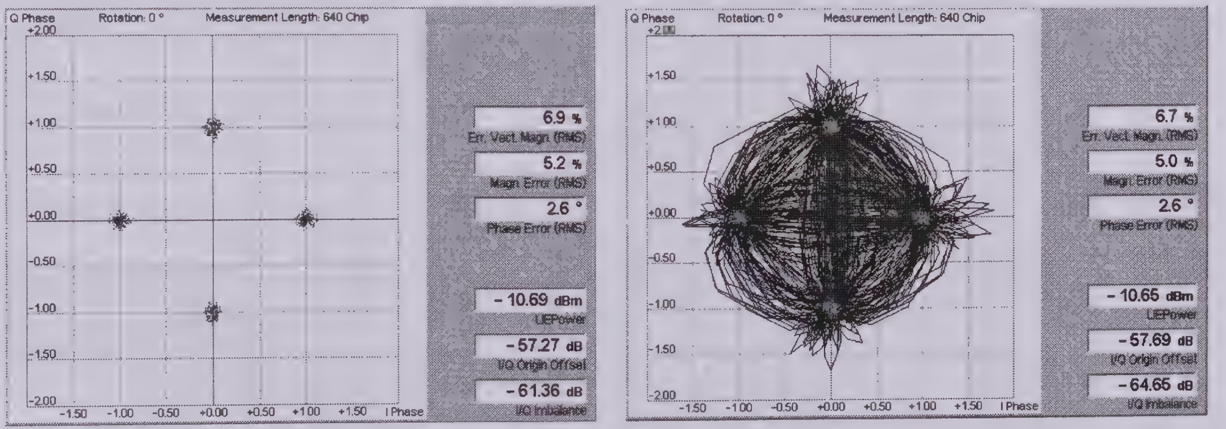
Remote control
`READ:ARRay:MODulation:EVMagnitude:QPSK:CURRent?` etc.

Display of the Modulation Vector (I/Q Analyzer)

The *I/Q Analyz. QPSK* provides five different graphical menus to display and analyze the modulation vector of the received QPSK signal. The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.53 ff.

a) Representation in the I/Q Plane

The *Constellation* and the *Vector* diagram both show the basic properties of the QPSK modulation vector in the I/Q plane. The menus display a parameter line, the actual test diagram, and six output fields for the standard modulation parameters.



Rotation: 0 ° Measurement Length: 640 Chip

6.9 % Err. Vect. Magn. (RMS)
5.2 % Magn. Error (RMS)
2.6 ° Phase Error (RMS)
- 10.69 dBm UEPower
- 57.27 dB I/Q Origin Offset
- 61.36 dB I/Q Imbalance

Rotation: 0 ° Measurement Length: 640 Chip

6.7 % Err. Vect. Magn. (RMS)
5.0 % Magn. Error (RMS)
2.6 ° Phase Error (RMS)
- 10.65 dBm UEPower
- 57.69 dB I/Q Origin Offset
- 64.65 dB I/Q Imbalance

Fig. 4-17 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

Settings/ Scalar results Settings and scalar measurement results are indicated in the parameter line above the test diagram and in the output table on the right side.

Parameter line The display settings (as set via the *Display* softkey or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on p. 4.53 ff.) are indicated in a parameter line across the top of the diagram:

Rotation The default setting for the rotation angle for I/Q representation *(Rotation = 0°)* corresponds to the standard WCDMA QPSK modulation scheme where the constellation points are located on the I and Q axes of the diagrams. A rotation by 45° corresponds to an alternative convention for the initial phase reference; see description of diagram below.

Meas. Length Time interval (number of consecutive chips) to be measured per single shot, equal to the number of points in the constellation diagram (640 chips or 2560 chips, corresponding to 1 complete WCDMA slot).

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields The output table shows the most important scalar modulation parameters; see section *Measurement of Modulation Parameters* on p. 4.30 ff. The *I/Q Imbalance* is a measure of the I/Q asymmetry of the diagram and therefore depends on the *Rotation* angle. The value for a rotation of 0° corresponds to the *I/Q Imbalance* displayed in the *Overview* application.

Remote control
`READ[:SCALar]:MODulation:IQANalyzer:QPSK?` etc.

Diagrams The constellation and vector diagrams trace the QPSK modulation vector in the normalized I/Q plane over a definite time interval. The normalized I amplitude <I> scales the horizontal axis, the normalized Q amplitude <Q> scales the vertical axis. The phase angle is given by

$$\varphi = \arctan(<Q>/<I>),$$

and the normalization is chosen so that the signal amplitude at the constellation points averaged over the measurement length is equal to 1.
The two diagrams differ in the way the result is displayed.

Constellation diagram In the *Constellation* diagram the modulation vector is only traced at the constellation points; the diagram shows a dot for each chip symbol. The constellation diagram of an ideal QPSK-modulated signal contains 4 constellation points with distance 1 from the origin and relative angles of π/2. Large variations of the symbol point positions in the constellation diagram indicate a poor signal quality; see Fig. 4-10REFFORMATVERBINDENFORMATVERBINDEN on p. 4.31.

In the QPSK application the symbol mapping between the logic data and the constellation points is not evaluated. As a consequence the overall phase of the diagram is random; a logic symbol may correspond to any of the four constellation points.

Note: *Due to the complex scrambling codes, even a single DPDCH or DPCCH generates a pattern with 4 constellation points.*

Vector diagram In the *Vector* diagram the modulation vector is traced with an oversampling factor of 4; the diagram shows a continuous curve. The vector diagram shows that the QPSK modulation scheme allows transitions between each pair of constellation points.

Settings A single shot measurement extends over the *Measurement Length* indicated in the parameter line above the diagram. The number of points in the constellation diagram after one single shot is equal to the measurement length in chips (each chip is mapped onto one QPSK constellation point). To customize the graphical representation it is possible to zoom the diagrams, keeping the origin at fixed position, and to display or remove the grid. Moreover, a fixed offset may be added to the phase angles *(Rotation)*; see section *Measurement Control (Modulation Configuration – Control)* on p. 4.53 ff.

Remote control
`READ:ARRay:MODulation:IQANalyzer:QPSK?` etc.

b) Representation of the Amplitudes vs. Time

The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams show the normalized amplitudes of the I and Q components of the modulation vector as a function of time (eye diagrams). The menus display a parameter line and the actual test diagrams. All diagrams are Cartesian diagrams, the time forming the x-axis.

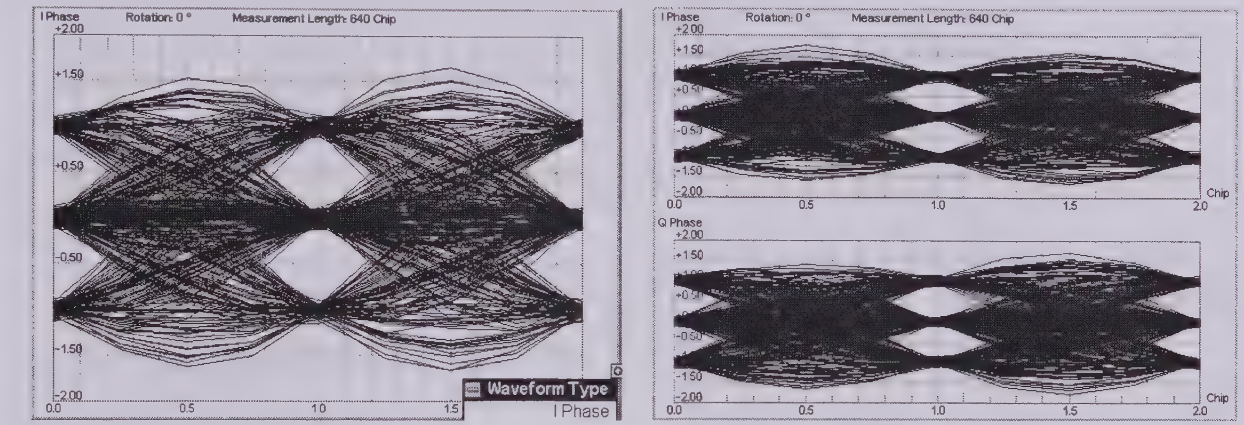


Fig. 4-18 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

Settings The parameter line above the test diagram displays the same settings as the constellation and vector diagrams; see section *Representation in the I/Q Plane* on p. 4.42 ff.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Diagram The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams trace the normalized I and Q amplitudes as a function of time. Diagrams of this type are often referred to as eye diagrams. The horizontal axis covers a fixed 2-chip time interval, starting at the time of a constellation point, whereas the total duration of a single shot measurement is given by the *Measurement Length.* The measurement curve restarts at the left diagram edge after each 2-chip period so that the complete diagram for a measurement length of 640 chips (2560 chips) contains 320 (1280) superimposed curves.

The number of nodes on the vertical axis of the I or Q eye diagram is equal to the number of different I or Q amplitudes in the constellation diagram. The number of eyes is equal to the number of nodes minus one. Smeared-out nodes and small eye apertures indicate a poor signal quality.

The *I Phase* and *Q Phase* diagrams are analogous; the combined *I Phase & Q Phase* diagram displays the *I Phase* diagram on top of the *Q Phase* diagram.

To customize the graphical representation it is possible to zoom the diagrams in vertical direction, keeping the zero-amplitude reference at fixed position, and to display or remove the grid. Moreover, a fixed offset may be added to the phase angles *(Rotation)*; see section *Measurement Control (Modulation Configuration –*

Control) on p. 4.53 ff. A rotation angle of 0° corresponds to the scenario in *Fig. 4-18* with 3 nodes on the vertical axis. The number of nodes is reduced to 2 (and the number of eyes to 1) if a rotation angle of 45° is selected.

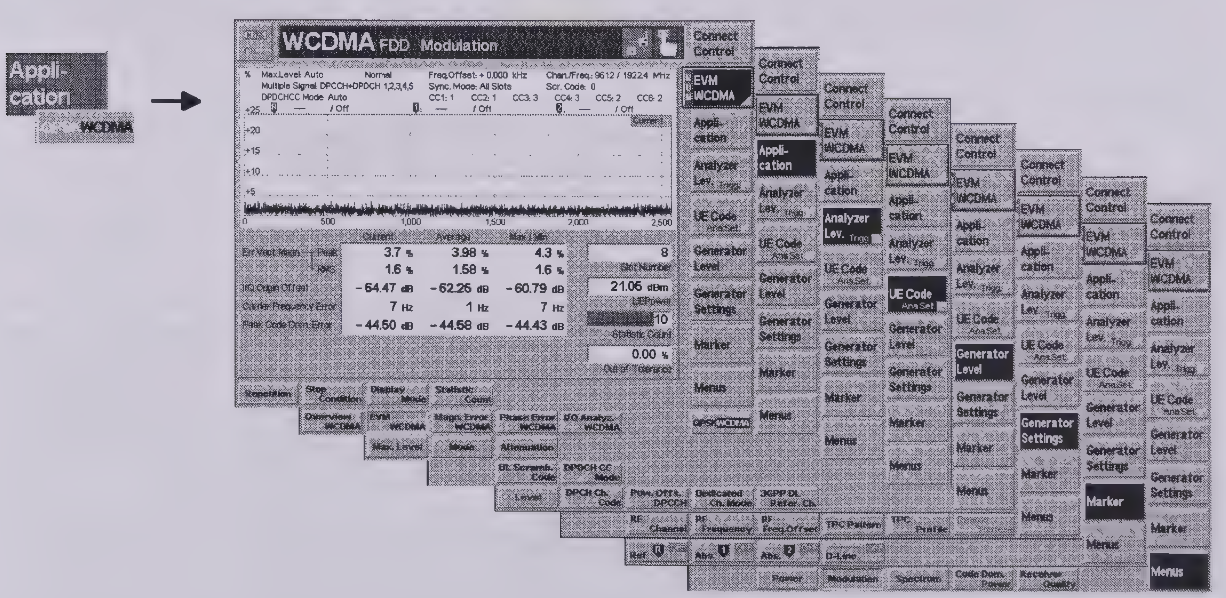
Remote control
`READ:ARRay:MODulation:IQANalyzer:QPSK?` etc.

Measurement Menu (Modulation – WCDMA)

If the *WCDMA* signal configuration is selected (see *Application* softkey in section *Test Settings* on page 4.35 ff.), the graphical measurement menu *Modulation* displays quantities characterizing the modulation accuracy of a 3GPP standard uplink signal with a chip rate of 3.84 Mcps and channel coding.

- The measurement control softkey *Overview WCDMA* (which changes to *EVM WCDMA, Magn. Error WCDMA, Phase Error WCDMA*, or *I/Q Analyz. WCDMA* if the corresponding application is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Modulation Configuration* (press twice). The hotkeys associated to the measurement control softkey define the scope of the Modulation measurement.
- The other softkeys to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.5.

The measurement menu *Modulation* can be accessed from any other measurement menu of the WCDMA UE function group using the *Modulation* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).


Appli-
cation
WCDMA
WCDMA FDD Modulation
%
+25
+20
+15
+10
+5
0
500
1,000
1,500
2,000
2,500
Current
Connect Control
EVM WCDMA
Appli-cation
Analyzer Lev. Trigg
UE Code Ana.Set.
Generator Level
Generator Settings
Marker
Menus
QPSK WCDMA
Repetition
Stop Condition
Display Mode
Statistic Count
Overview WCDMA
EVM WCDMA
Magn. Error WCDMA
Phase Error WCDMA
I/Q Analyz. WCDMA
Max. Level
Mode
Attenuation
UL Scramb. Code
DPDCH CC Mode
Level
DPCH Ch. Code
Pow. Offs. DPCCH
Dedicated Ch. Mode
3GPP DL Refer. Ch.
RF Channel
RF Frequency
RF Freq.Offset
TPC Pattern
TPC Profile
Ref
Abs.
D-Line
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz
Multiple Signal: DPCCH+DPDCH 1,2,3,4,5 Sync. Mode: All Slots Scr. Code: 0
DPDCHCC Mode: Auto CC1: 1 CC2: 1 CC3: 3 CC4: 3 CC5: 2 CC6: 2

		Current	Average	Max / Min
Err.Vect.Magn.	Peak	3.7 %	3.98 %	4.3 %
	RMS	1.6 %	1.58 %	1.6 %
I/Q Origin Offset		− 64.47 dB	− 62.25 dB	− 60.79 dB
Carrier Frequency Error		7 Hz	1 Hz	7 Hz
Peak Code Dom. Error		− 44.50 dB	− 44.58 dB	− 44.43 dB

Slot Number: 8
UE Power: 21.06 dBm
Statistic Count: 10
Out of Tolerance: 0.00 %

Fig. 4-19 Measurement menu Modulation – EVM WCDMA

Test Settings

The *Analyzer Level, Analyzer Settings* and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.6). The *Overview WCDMA* measurement control softkey and the *Marker* and *Display* softkeys behave like in the QPSK signal configuration; see section *Test Settings* on page 4.35. The following softkeys and hotkeys differ from the *Modulation – QPSK* measurement:

Application

The *Application* softkey selects the measurement application and the signal configuration.

The alternative diagrams (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.53 ff.).

Overview WCDMA

The *Overview WCDMA* hotkey selects all scalar modulation results to be displayed. For an explanation of the measured quantities see section *Measurement of Modulation Parameters* on page 4.30.

Remote control
No explicit switchover command. All *Overview WCDMA* measurements are identified by the 3rd/4th/5th level keywords `...OVERview:WCDMa:DPCH...`

EVM WCDMA

The *EVM WCDMA* hotkey selects the magnitude of the error vector to be displayed. The error vector connects the measured signal from the UE and the ideal signal vector at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.30. The diagram shows the relative magnitude (in percent), i.e. the ratio of the magnitude of the error vector to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *EVM WCDMA* measurements are identified by the 3rd/4th level keywords `...EVMagnitude:WCDMa:DPCH...`

Phase Err. WCDMA

The *Phase Error WCDMA* hotkey selects the phase error of the modulation vector to be displayed.

The phase error is the difference in phase between the measured signal from the UE and an ideal signal waveform at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.30.

Remote control
No explicit switchover command. All *Phase Error WCDMA* measurements are identified by the 3rd/4th level keywords `...PERRor:WCDMa:DPCH...`

Magn. Err. WCDMA

The *Magnitude Error WCDMA* hotkey selects the magnitude error of the modulation vector to be displayed.

The magnitude error is the difference in magnitude between the measured signal from the UE and an ideal signal waveform at the symbol points, see explanation in section *Measurement of Modulation Parameters* on page 4.30. The diagram shows the relative magnitude error (in percent), i.e. the ratio of the absolute magnitude error to the magnitude of the ideal signal vector.

Remote control
No explicit switchover command. All *Magn. Error WCDMA* measurements are identified by the 3rd/4th level keywords `...MERRor:WCDMa:DPCH...`

I/Q Analyz. WCDMA

The *I/Q Analyz. WCDMA* hotkey selects the diagrams to display the modulation vector in the I/Q plane (constellation diagram, vector diagram) and the phase of the I and Q component *(I Phase, Q Phase, I Phase & Q Phase).*

The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.53 ff.

Remote control
No explicit switchover command. All *I/Q Analyz WCDMA* measurements are identified by the 3rd/4th level keywords `...IQANalyzer:WCDMa...`

QPSK WCDMA

The *QPSK WCDMA* hotkey toggles between QPSK or WCDMA signal configuration.

The current signal configuration is marked in inverse video (white typeface on a dark background). Selecting another signal configuration also changes the *Modulation* measurement menu; see section *Measurement of Modulation Parameters* on page 4.30 ff.

Remote control
QPSK and WCDMA modulation is selected by the keywords `:QPSK` and `:WCDMA` in the command headers, respectively.

UE Code Ana. Set.

The *UE Code* softkey defines the properties of the multiple uplink WCDMA signal that the CMU is able to analyze. For a description of the WCDMA signal see background information in section *Measurement Menu (Modulation – WCDMA)* on page 4.45 f. Most of the *UE Code* settings are also accessible via the *UE Code* tab of the *Connection Control* menu p. 4.106 ff. The measurement fails if the input signal does not conform to the *UE Code* settings.

If pressed once again, the selected *UE Code* softkey changes to the *Analyzer Settings* softkey, see section *Test Settings* on page 4.6.

Note: *In Signalling mode, there is no need to set the* UE Code *parameters* Multiple Signal and Sym. Rate/Chan. Code. *The parameters are implicitly included in the dedicated channel settings. The* UL Scrambling Code *that the UE shall use can be set in the* UE Signal *tab and doesn't have to be configured at the UE.*

Multiple Signal

The hotkey *Multiple Signal* selects the physical channels that contribute to the multiple uplink WCDMA signal.

DPCCH	Signal consists of one single Dedicated Physical Control Channel
DPCCH+DPDCH1,...n	Signal consists of one DPCCH to which n Dedicated Physical Data Channels are added. n can vary between 1 and 6 so that it is possible to superimpose up to 7 signals as shown in *Fig. 4-13* on p. 4.34.

This setting is ignored if the *DPDCH CC Mode* is set to *Auto.*

Remote control
`CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>`

UL Scramb. Code

The *UL Scramb. Code* hotkey selects the number of the long code that is used to scramble the WCDMA signal. The scrambling code number must be in the range 0 to FFFFFF (hex), corresponding to 0 to 16777215 decimal.

If the input signal does not conform to the *Scrambling Code* settings the measurement fails and the CMU displays the warning message *Scrambling code or Slot Format does not match input signal.*

Remote control

```
CONFigure:UECode:DPCH:SCODe <Code>
```

DPDCH CC Mode

The *DPDCH CC Mode* hotkey selects one of the following DPDCH channelization code modes:

Auto	The CMU analyzes the signal from the WCDMA UE and searches for the DPDCH channelization codes. The conditions for the code search are defined in the *Auto Settings* section in the *UE Code* tab of the *Connection Control* menu; see *p.* 4.106 ff.: They comprise the symbol rate and a power threshold to distinguish the DPDCH from unwanted noise. The code search also works with more than one data channel where the symbol rate is known to be 960 kbps: The CMU detects all DPDCHs with a power above the threshold. If the DPDCH symbol rate set must be larger or equal than the actual symbol rate of the measured signal, otherwise the measurement will fail.
Manual	The CMU analyzes the signal from the WCDMA UE under the assumption that the symbol rates, channelization codes and multiple signal configuration are as set in the *Manual Settings* section in the *UE Code* tab of the *Connection Control* menu; see *p.* 4.106 ff. The *Manual Settings* are equivalent to the hotkeys *Multiple Signal* and *Sym. Rate Chan. Code.*

The measurement speed in *Manual* mode is higher than in *Auto* mode. *Auto* mode can be used if the channelization code of the signal to be analyzed is unknown.

Remote control

```
CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode
  MANual | AUTomatic
```

Symbol Rate

The *Symbol Rate* hotkey calls up a list of the symbol rate and channelization code for the DPCCH and each of the six CPDCHs that can contribute to the multiple WCDMA signal. If a *DPCCH+DPDCH1* multiple signal is analyzed, the symbol rate of the data channel *DPDCH1* can be set; the channelization code will be automatically adapted according to the rules in the 3GPP standard. For other multiple signal configurations, symbol rates and channelization codes are fixed.

The *Sym. Rate* settings are ignored if the *DPDCH CC Mode* is set to *Auto;* see above.

Remote control

```
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Rate>,<Code>
```

Measurement Results

The values shown in the *Modulation* measurement menus can be divided into three groups:

- Setting values
- Scalar measurement results (single values)
- Arrays (curves plotted as a function of time)

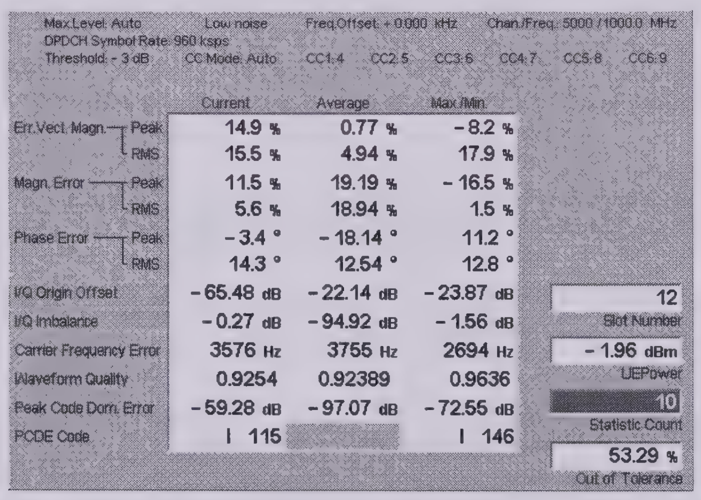
The measurement menu for the *Overview* application shows all scalar results but no curve. The measurement menus for the *EVM, Magn. Err.* and *Phase Err.* applications are analogous to each other and show the phase error, the (relative) magnitude error or the (relative) error vector magnitude as a function of time and the corresponding peak and effective values. The range and unit of the y-axis is adjusted to the measured quantity. The *I/Q Analyzer* application provides a graphical analysis of the the modulation vector in the I/Q plane.

Scalar Results (Overview)

The measurement menu for the application *Overview WCDMA* shows all scalar results. Most of the values are indicated in tabular form:

Parameter lines

Output table
and additional fields



Max.Level: Auto Low noise Freq.Offset: + 0.000 kHz Chan./Freq.: 5000 / 1000.0 MHz
DPDCH Symbol Rate: 960 ksps
Threshold: - 3 dB CC Mode: Auto CC1: 4 CC2: 5 CC3: 6 CC4: 7 CC5: 8 CC6: 9

		Current	Average	Max./Min.
Err.Vect. Magn.	Peak	14.9 %	0.77 %	- 8.2 %
	RMS	15.5 %	4.94 %	17.9 %
Magn. Error	Peak	11.5 %	19.19 %	- 16.5 %
	RMS	5.6 %	18.94 %	1.5 %
Phase Error	Peak	- 3.4 °	- 18.14 °	11.2 °
	RMS	14.3 °	12.54 °	12.8 °
I/Q Origin Offset		- 65.48 dB	- 22.14 dB	- 23.87 dB
I/Q Imbalance		- 0.27 dB	- 94.92 dB	- 1.56 dB
Carrier Frequency Error		3576 Hz	3755 Hz	2694 Hz
Waveform Quality		0.9254	0.92389	0.9636
Peak Code Dom. Error		- 59.28 dB	- 97.07 dB	- 72.55 dB
PCDE Code		I 115		I 146

Slot Number: 12
UEPower: - 1.96 dBm
Statistic Count: 10
Out of Tolerance: 53.29 %

Fig. 4-20 Display of results (Modulation – Overview WCDMA)

Parameter lines The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

The two lines below indicate the properties of the measurement and of the analyzed WCDMA signal as defined by means of the *UE Code* softkey (see p. 4.47) and/or the *UE Code* tab of the *Connection Control* menu; *p.* 4.106 ff.:

Multiple Signal	Physical channels that contribute to the WCDMA signal
Sync. Mode	Synchronization between the WCDMA signal and the CMU: *All Slots*

Scr. Code	Scrambling code number of the WCDMA signal
DPDCH CC Mode	Manual or automatic detection of the channelization code
CCn	Channelization codes of the data channels $DPDCH_1$ to $DPDCH_6$

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output table The scalar values in the output table are explained in section *Measurement of Modulation Parameters* on p. 4.30 ff. In addition to the values in the QPSK application (see section *Scalar Results (Overview)* on page 4.30 ff., the Peak Code Domain Error and the and the code number with the largest code domain error is displayed.

C

Limit Check A red output field and an arrow pointing upwards or downwards indicates that the measurement result exceeds the upper or lower limit set in the *Limits* tab of the *Modulation* configuration menu, see p. 4.56.

Additional fields Four output fields to the right of output table indicate the following results and settings:

Slot Number	Number of the measured slot of the captured signal within the 10 ms frame and in the range 0 to 14. The CMU detects the slot number from the pilot bits in the captured signal. *6.127.*
UE Power	Average power in the current evaluation period (irrespective of the display mode selected and of the curve in the other WCDMA applications).
Statistic Count	Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Out of Tolerance	Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).
`READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?` etc.
`READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?` etc.

```
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:
       MATChing:LIMit?
```

Test Diagrams (EVM, Phase Error, Magn. Error)

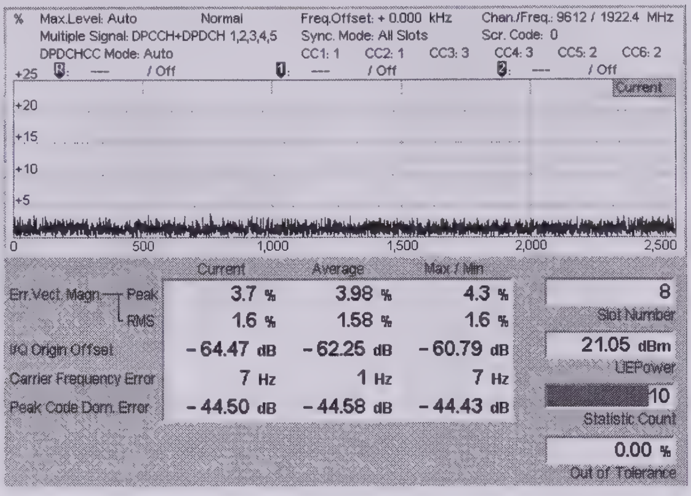
The graphical measurement menus for the three applications *EVM WCDMA*, *Magn. Error WCDMA*, and *Phase Error WCDMA* are analogous. The results are indicated in a parameter line, the test diagram, and a tabular overview below:

Parameter line

Test diagram

Output fields

and table



% Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz
Multiple Signal: DPCCH+DPDCH 1,2,3,4,5 Sync. Mode: All Slots Scr. Code: 0
DPDCHCC Mode: Auto CC1: 1 CC2: 1 CC3: 3 CC4: 3 CC5: 2 CC6: 2
R: --- / Off 1: --- / Off 2: --- / Off

		Current	Average	Max / Min
Err.Vect. Magn.	Peak	3.7 %	3.98 %	4.3 %
	RMS	1.6 %	1.58 %	1.6 %
I/Q Origin Offset		- 64.47 dB	- 62.25 dB	- 60.79 dB
Carrier Frequency Error		7 Hz	1 Hz	7 Hz
Peak Code Dom. Error		- 44.50 dB	- 44.58 dB	- 44.43 dB

8
Slot Number

21.05 dBm
UEPower

10
Statistic Count

0.00 %
Out of Tolerance

Fig. 4-21 Display of results (Modulation – EVM / Phase Error / Magn. Error WCDMA)

Settings/ Scalar results The parameter lines above the graphical diagram are identical to the ones shown in the *Overview* application; see section *Scalar Results (Overview)* on page 4.49 ff.

Output table/ Additional fields The output table shows a subset of the results provided in the *Overview* application; see section *Scalar Results (Overview)* on page 4.49 ff. The four output fields to the right of the output table are also provided in the *Overview* application.

Curves (arrays) The graphical diagram is analogous to the diagram in the QPSK application, see section *Test Diagrams (EVM, Phase Error, Magn. Error)* on page 4.40 ff. The curve refers to the multiple WCDMA signal measured.

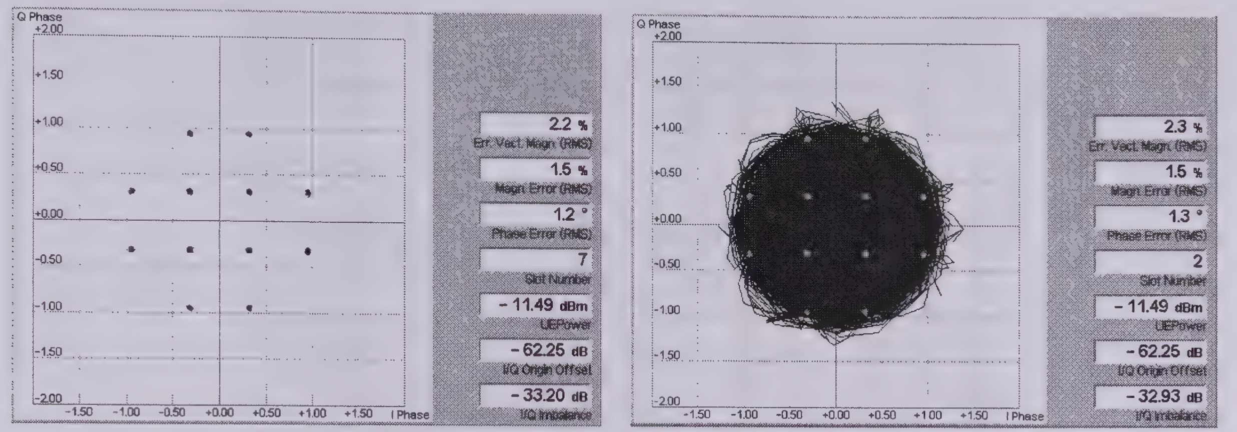
Remote control
`READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?` etc.

Display of the Modulation Vector (I/Q Analyzer)

The *I/Q Analyz. WCDMA* provides five different graphical menus to display and analyze the modulation vector of the received WCDMA signal. The diagram type is selected via *Display – Waveform* or in the configuration menu; see section *Measurement Control (Modulation Configuration – Control)* on page 4.53 ff.

c) Representation in the I/Q Plane

The *Constellation* and the *Vector* diagram both show the basic properties of the WCDMA modulation vector in the I/Q plane. The menus display the actual test diagram and seven output fields for the slot number and the standard modulation parameters. The example below shows a WCDMA signal configuration with 1 DPCCH and 2 DPDCHs, all with equal amplitude.



2.2 % Err. Vect. Magn. (RMS)
1.5 % Magn. Error (RMS)
1.2 ° Phase Error (RMS)
7 Slot Number
- 11.49 dBm UEPower
- 62.25 dB I/Q Origin Offset
- 33.20 dB I/Q Imbalance

2.3 % Err. Vect. Magn. (RMS)
1.5 % Magn. Error (RMS)
1.3 ° Phase Error (RMS)
2 Slot Number
- 11.49 dBm UEPower
- 62.25 dB I/Q Origin Offset
- 32.93 dB I/Q Imbalance

Fig. 4-22 Display of results (Modulation – I/Q Analyzer – Constellation/Vector)

Settings/ Scalar results

The scalar modulation indicated in the output fields on the right side are analogous to the *I/Q Analyz. QPSK* menus; see section *Representation in the I/Q Plane* on p. 4.42 ff. The slot number is indicated in addition. No parameter line is displayed, because the overall phase of the diagram and the measurement length are fixed. This means that the *I/Q Imbalance* is also unambiguous; it corresponds to the value displayed in the *Overview* application.

Remote control
`READ[:SCALar]:MODulation:IQANalyzer:WCDMa?` etc.

Diagram

The constellation and vector diagrams are analogous the diagrams for single QPSK-modulated signals, however, more constellation points occur if several signals with different power contribute to the analyzed WCDMA signal. The example in *Fig. 4-22* shows a WCDMA signal configuration with 1 DPCCH and 2 DPDCHs, all with equal amplitude. In contrast to the QPSK application, the WCDMA measurement does evaluate the symbol mapping between the logic data and the constellation points. This means that the phase ambiguity of the diagrams is resolved; no additional rotation angle is provided.

Remote control
`READ:ARRay:MODulation:IQANalyzer:WCDMa?` etc.

d) Representation of the Amplitudes vs. Time

The *I Phase,* the *Q Phase,* and the *I Phase & Q Phase* diagrams show the normalized amplitudes of the I and Q components of the modulation vector as a function of time (eye diagrams). All diagrams are Cartesian diagrams, the time forming the x-axis.

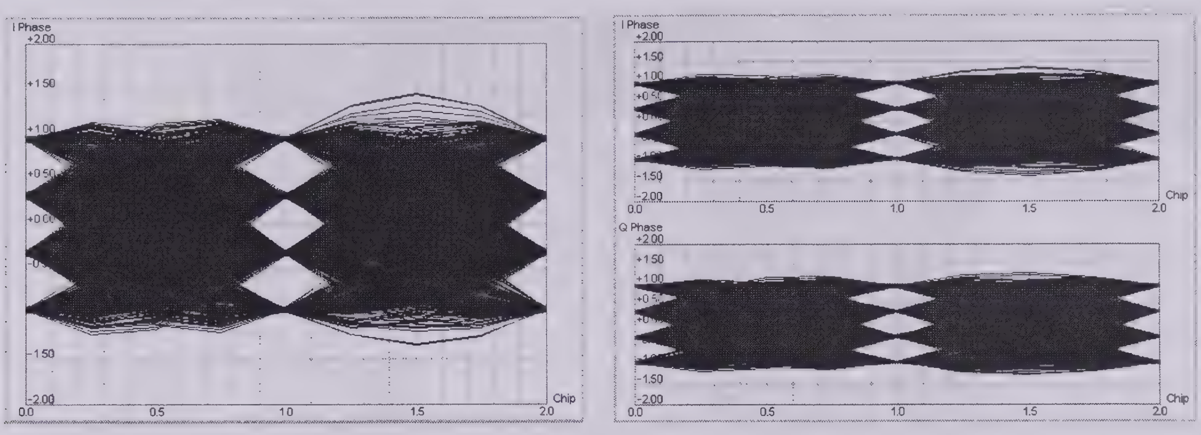


Fig. 4-23 Display of results (Modulation – I/Q Analyzer – I Phase / Q Phase)

Diagram

The *I Phase*, the *Q Phase*, and the *I Phase & Q Phase* diagrams are analogous to the diagrams for single QPSK-modulated signals, however, more nodes and eyes occur as several signals with different power contribute to the analyzed WCDMA signal and the constellation diagram becomes more complex.

Remote control
`READ:ARRay:MODulation:IQANalyzer:WCDMa?` etc.

Measurement Configurations (Modulation Configuration)

The popup menu *Modulation Configuration.* contains two tabs to determine the parameters of the *Modulation* measurement including the error tolerances.

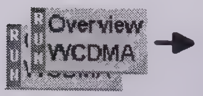
The popup menu *Modulation Configuration* is activated by pressing the measurement control softkey (labeled *Overview QPSK, EVM QPSK, ...* depending on the signal configuration and application selected) in the top right of the graphical measurement menu *Modulation* twice. By pressing the associated hotkeys, it is possible to change between the tabs.

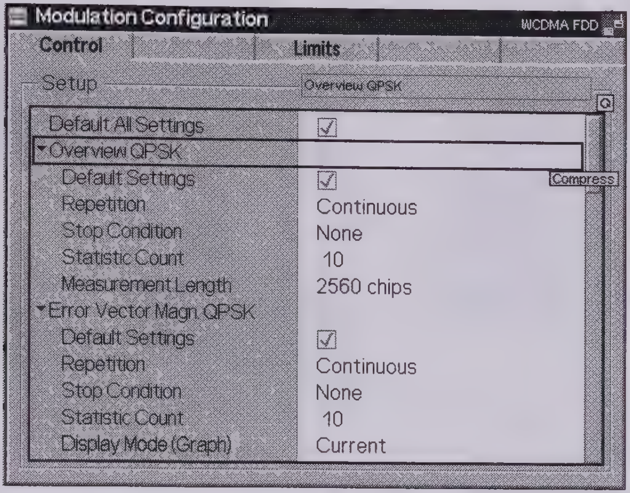
Measurement Control (Modulation Configuration – Control)

The *Control* tab controls the *Modulation* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement (except for the *I/Q Analyzer* applications)
- The measurement curve displayed *(Display Mode*, not for applications *Overview QPSK* and *Overview WCDMA* and the *I/Q Analyzer* applications*)*
- The number of slots/evaluation periods forming a statistics cycle *(Statistic Count,* except for the *I/Q Analyzer* applications*)*
- The number of chips measured and displayed in the graphical diagrams *(Measurement Length,* for single QPSK signals only)
- The *Channelization Code Mode* (for WCDMA signal configuration only)
- The display settings for the *I/Q Analyzer (Rotation, Zoom, Waveform Type)*

Besides, it influences the graphical measurement menus by adding or removing the *Grid*.





Setup: Overview QPSK

Default All Settings	☑
Overview QPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Measurement Length	2560 chips
Error Vector Magn. QPSK	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Display Mode (Graph)	Current

Fig. 4-24 Modulation Configuration – Control

The settings can be defined separately for the different applications of the Modulation measurement group. Most functions comply with those of the *Control* tab of the *Power Configuration* menu (see page 4.18). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `MODulation:<Mod_Application>`. The following parameters are specific to the *Modulation* measurement:

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual signal configurations are provided.

Remote control
`DEFault:MODulation:OVERview:QPSK:CONTrol ON | OFF etc.`

Measurement Length The *Measurement Length* parameter selects a time interval (number of consecutive chips) to be measured per single shot. In graphical diagrams, the *Measurement Length* is identical with the time range displayed. The following values are provided:

2560 Chips	The measurement extends over the complete WCDMA slot comprising 2560 chips.
640 Chips	The measurement extends over the first quarter of the WCMDA slot.

A short measurement length reduces the measurement time. The *6.127*) beginning of the WCDMA slot is determined by detecting the pilot bits in the DPCCH. Note that the position of the *Measurement Length* within the slot differs from the *Code Domain Power* measurement where it is influenced by the trigger settings.

Remote control
`CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth <No_chips>`

Display Mode The *Display Mode* hotkey selects one of the following display modes for the measurement curve:

Current	Measured value for current evaluation period
Max./Min.	Extreme value of a number of evaluation periods (maximum or minimum, whichever has the larger absolute value)
Average	Average value of a number of evaluation periods, referenced to a statistics cycle

The basic evaluation period can be set to either an entire slot or the first quarter of a slot; see *Measurement Length* above and Chapter 3.The calculation of the measurement curves and the rules for averaging is also described in Chapter 3, section *General Settings*. No *Display Mode* is available in the *Overview...* applications where no measurement curve is displayed.

Remote control
No display mode set explicitly, the three measurement curves are accessible via:

```
FETCh:ARRay:MODulation:EVMagnitude:QPSK:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:AVERage? etc.
```

Channelization Code Mode

The *Channelization Code* function defines whether the CMU analyzes the received WDCMA signal and searches for the channelization codes *(Auto)* or whether the channelization codes are assumed to be known *(Manual)*. It is equivalent to the *DPDCH CC Mode* softkey described on p. 4.48.

Remote control

```
CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode
             MANual | AUTomatic
```

The following parameters are valid for the *I/Q Analyzer* measurements only:

Rotation

Rotation defines the initial phase reference (φ = 0) in the *Correlation* and *Vector* diagram of the QPSK applications:

0°	The diagrams are rotated so that the constellation points are located on the I and Q axes (standard WCDMA QPSK convention).
45°	The diagrams are rotated so that the constellation points are located on the angle bisectors between the I and Q axes.

In the QPSK application the symbol mapping between the logic data and the constellation points is not evaluated. As a consequence the overall phase of the diagram is random; a logic symbol may correspond to any of the four constellation points. In the WCDMA application, where the symbol mapping is evaluated and the position of the constellation points is fixed, no rotation angle is provided.

The rotation angle also has an impact on the eye diagrams; see section *Representation of the Amplitudes vs. Time* on p. 4.44 ff.

Remote control

```
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:ROTation 0 | 1
```

Zoom

Zoom magnifies the diagram with an equal factor in horizontal and vertical direction, leaving the center (i.e. the intersection between the I and Q axis) at fixed position:

Normal	The normalized I and Q amplitudes range between –2 and +2.
Factor n	The normalized I and Q amplitudes range between –2/n and +2/n, where n = 2, 5, 10, 20.

Remote control
no command, display configuration only.

Waveform Type *Waveform Type* selects the diagram type:

Correlation	Correlation diagram; see section *Representation in the I/Q Plane* on p. 4.42 ff.
Vector	Vector diagram; see section *Representation in the I/Q Plane* on p. 4.42 ff.
I Phase	Eye diagram of the I amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.44 ff.
Q Phase	Eye diagram of the Q amplitude; see section *Representation of the Amplitudes vs. Time* on p. 4.44 ff.
I Phase & Q Ph.	Eye diagrams of the I and Q amplitude in a single diagram; see section *Representation of the Amplitudes vs. Time* on p. 4.44 ff.

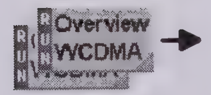
Remote control
no command, display configuration only.

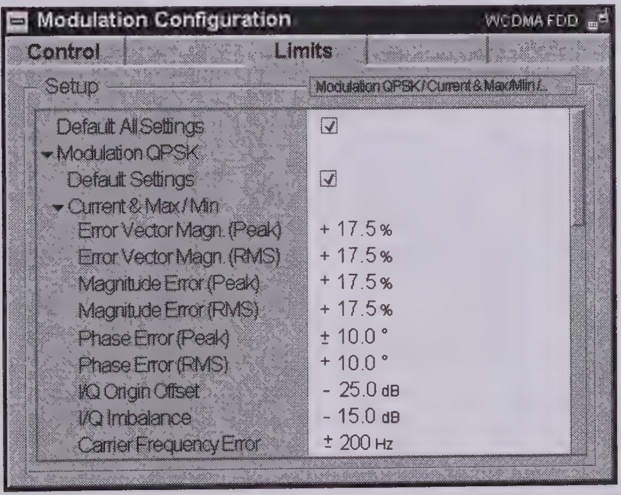
Tolerance Values (Modulation Configuration – Limits)

The *Limits* tab defines upper and lower error limits for the parameters of the *Modulation* measurement.

Conformance requirements A poor modulation accuracy of the UE transmitter increases the transmission errors in the uplink channel of the WCDMA network.

The Error Vector Magnitude (EVM) is the critical quantity to assess the modulation accuracy of a WCDMA UE. According to the 3GPP standard, the EVM measured at UE output powers ≥ −20 dBm and under normal operating conditions shall not exceed 17.5 %. In addition, the Peak Code Domain Error, which is the maximum EVM of all code channels, shall not exceed −15 dB. The frequency error shall not exceed ±0.1 ppm.





Modulation QPSK / Current & Max/Min /...

Default All Settings	☑
Modulation QPSK	
Default Settings	☑
Current & Max / Min	
Error Vector Magn. (Peak)	+ 17.5 %
Error Vector Magn. (RMS)	+ 17.5 %
Magnitude Error (Peak)	+ 17.5 %
Magnitude Error (RMS)	+ 17.5 %
Phase Error (Peak)	± 10.0 °
Phase Error (RMS)	+ 10.0 °
I/Q Origin Offset	- 25.0 dB
I/Q Imbalance	- 15.0 dB
Carrier Frequency Error	± 200 Hz

Fig. 4-25 Modulation Configuration – Limits

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual signal configurations are provided.

Remote control
`DEFault:MODulation:OEMP:QPSK:LIMit ON | OFF`
`DEFault:MODulation:OEMP:WCDMa:DPCH:LIMit ON | OFF`

Modulation QPSK

The *Modulation QPSK* table section defines upper limits for the different modulation parameters in single channel signal configuration (application *QPSK)*.

Current & Max./Min.	Common limits for the *Current* scalar results and for the *Minimum/Maximum* scalar results
Average	Limits for the *Average* measurement scalar results

The meaning of the error limits is the same for the *Current* or *Minimum/Maximum (Current & Max.)* and the *Average* results. The modulation parameters are explained in section *Measurement of Modulation Parameters* on p. 4.30 ff.

The *Phase Error (Peak)* and the *Frequency Error* are quantities with alternating sign; the corresponding limits are symmetric to the origin (i.e. the absolute value of both quantities must fall below the specified positive limit).

Remote control

```
CONFigure:MODulation:OEMP:QPSK:CMMax:LIMit:[SCALar]:
         SYMMetric:[COMBined]:VALue
CONFigure:MODulation:OEMP:QPSK:AVERage:LIMit:[SCALar]:
         SYMMetric:[COMBined]:VALue
```

Modulation WCDMA (DPCH)

The Modulation WCDMA (DPCH) table section defines upper limits for the different modulation parameters in multiple channel signal configuration (application WCDMA). Most of the settings are analogous to the Modulation QPSK section, see above.

Compared to the QPSK measurement, the allowed range of WCDMA carrier Frequency Error limits is smaller. Moreover, a limit for the Peak Code Domain Error is provided:

Remote control

```
CONFigure:MODulation:OEMP:WCDMa:DPCH:CMMax:LIMit:[SCALar]:
         SYMMetric:[COMBined]:VALue
CONFigure:MODulation:OEMP:WCDMa:DPCH:AVERage:LIMit:[SCALar]:
         SYMMetric:[COMBined]:VALue
```

Spectrum Measurements

The menu group *Spectrum* comprises the functions for measurement of the output RF spectrum emissions that are plotted in the frequency domain. The measurement results are displayed in the graphical measurement menu *Spectrum,* the popup menu *Spectrum Configuration* is used for configuration of the measurements.

The *Spectrum* measurement serves to measure the amount of energy that spills outside the designated radio channel. An excess amount of off-carrier power increases the interference with adjacent channels and decreases the system capacity. The off-carrier power can be assessed by several different parameters:

ACLR	The Adjacent Channel Leakage power Ratio (ACLR) measured by the CMU is the ratio of the power measured in an adjacent channel (Adjacent Channel Power, ACP) to the transmitted carrier power, expressed in dB. This definition differs from the 3GPP specification by a minus sign but is in line with other systems like GSM and TDMA.
OBW	The Occupied Bandwidth (OBW) is the width of a frequency range around the assigned channel frequency containing 99% of the total integrated power of the transmitted spectrum.
Emission Mask	The *Spectrum Emission Mask* is a template to limit the out-of-band emissions in a frequency range between 2.5 MHz and 12.5 MHz away from the UE center carrier frequency.

Fig. 4-26 below illustrates the different quantities that can be obtained in the *Spectrum* measurement. *Fig. 4-26*

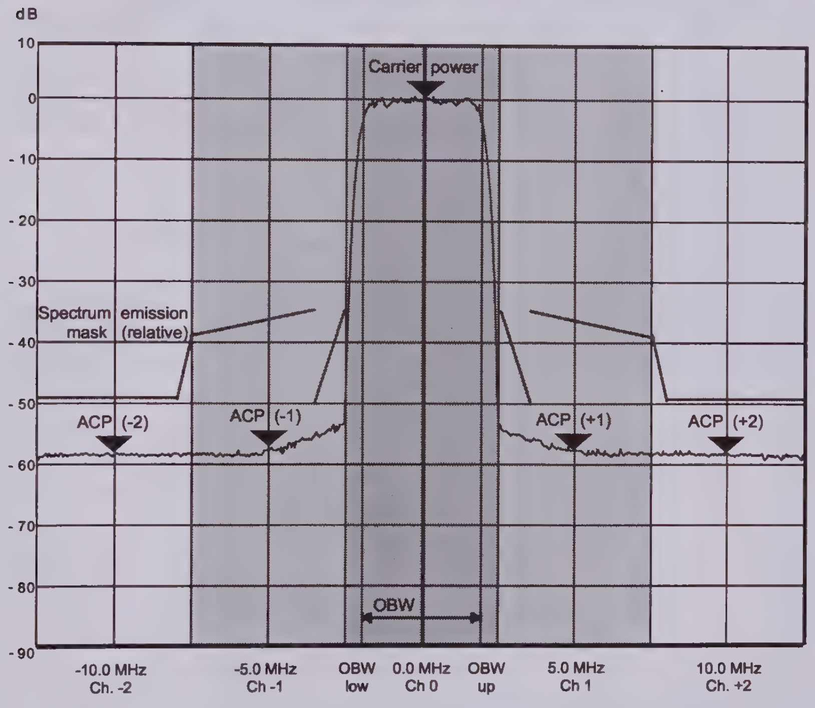


Fig. 4-26 Test parameters in the Spectrum measurement

To determine the ACLR and OBW, the CMU applies one of the following measurement methods:

ACLR

According to the standard, the Adjacent Channel Leakage power Ratio (ACLR) is measured at maximum output power of the UE and with an RRC filter that has a roll-off $\alpha = 0.22$ and a bandwidth equal to the chip rate. The measurement is carried out at the nominal carrier frequency, at ±5 MHz from the nominal frequency (1st adjacent channels), and at ±10 MHz (2nd adjacent channels or alternate channels). To activate this measurement method, the *ACLR Filter* application must be selected.

The CMU provides an alternative measurement method for the ACLR where the signal power is first measured as a function of time at constant frequencies using a filter of definite bandwidth and then transformed to the frequency domain by means of a Fast Fourier

Transform (FFT). After resampling in the frequency domain with an appropriate resolution, the FFT provides a spectral curve representing the current transmit power in a 25 MHz wide frequency range centered around the carrier frequency.

The resampled FFT curve is weighted with an RRC filter response, integrated in the frequency domain and divided by the power at the carrier frequency. This is done numerically on a point by point basis. This second filter stage yields a curve representing the ACLR which is smoothed and rescaled compared to the original FFT curve. The filtered ACLR curve is suitable to derive average and statistical quantities. To activate the FFT measurement method, the *ACLR FFT/OBW* application must be selected.

OBW

According to the standard, the Occupied Bandwidth (OBW) is measured at maximum output power of the UE, over a frequency span of 10 MHz and using a resolution filter of Gaussian shape with a bandwidth of less than 30 kHz. The CMU uses the FFT method to determine the OBW. From the spectral curve, the lower and upper OBW limit frequencies below and above which 0.5% of the total integrated power is transmitted are calculated. The OBW is then the difference between the upper and lower limit frequency. To obtain the OBW values, the *ACLR FFT/OBW* application must be selected.

Spectrum Emission

According to the standard, the spectrum emission of the UE is measured at maximum output power of the UE, in a frequency range between 2.5 MHz and 12.5 MHz away from the UE center carrier frequency and using a resolution filter of Gaussian shape with a bandwidth of 30 kHz (for frequencies between 2.515 MHz and 3.485 MHz from the carrier) or 1 MHz (for frequencies between 4 MHz and 12 MHz). All measured spectrum emission values are represented relative to the UE output power measured in a 3.84 MHz bandwidth (reference power).

Again, the CMU uses the FFT method to determine the spectrum emission. It is possible to use the same spectral curve as for the ACLR and OBW measurement, however, to account for the narrow-band Gaussian filter specified in the standard, the curve is resampled with a finer resolution. This improves the accuracy but increases the measurement time. *Spectrum* measurements will therefore be faster if there is no need to calculate the spectrum emissions. The filtered curve is displayed in three diagrams showing the frequency ranges where the bandwidth of the specified resolution filter is constant. To obtain the spectrum emission values, the *Emission Mask* application must be selected.

A *Spectrum* measurement in *Signalling* mode with a *Closed Loop* TPC pattern causes a strong increase of the UE output power while the CMU measures at off-carrier frequencies. To prevent this behavior, all *Spectrum* measurements are performed as follows (see also ; see Table 4-23 on p. 4.174):

- If a *Spectrum* measurement is switched *ON* while a *Closed Loop* pattern is active, this pattern is suspended and replaced by an *Alternating 0,1* pattern. *Alternating 0,1* is indicated in the *BS Signal* tab of the *Connection Control* menu. *Closed Loop* is re-activated the end of the *Spectrum* measurement.
- All other TPC patterns are left unchanged when a *Spectrum* measurement is switched on.
- While the *Spectrum* measurement is running, the TPC pattern can be changed, and it is even possible to activate a *Closed Loop* pattern. The changed patterns remain valid after the end of the *Spectrum measurement.*

Important Note

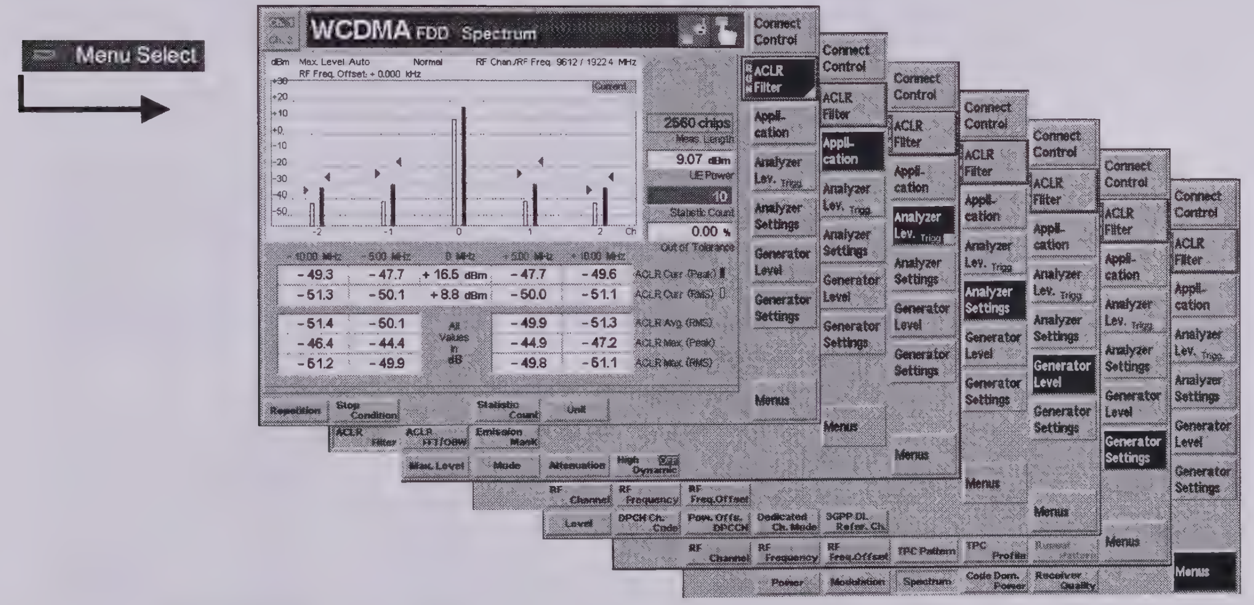
Observe the TPC Pattern *settings when performing* Spectrum *measurements. In particular, keep in mind that activating* Closed Loop *in a running* Spectrum *measurement is likely to cause undesirable changes of the UE power. To measure the ACLR and OBW at maximum transmitter output power of the UE as stipulated in the conformance test specification, use an* All 1 *TPC pattern.*

Measurement Menu (Spectrum)

The graphical measurement menu *Spectrum* displays the measurement results for the output RF spectrum emissions.

- The measurement control softkey *ACLR Filter* (which changes to *ACLR FFT/OBW or Emission Mask* if one of these applications is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Spectrum Configuration.* The hotkeys associated to the measurement control softkey define the scope of the *Spectrum* measurement.
- The softkeys *Application, Analyzer Level, Analyzer Settings, Marker* and *Menus* to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.5.

The measurement menu *Spectrum* can be accessed from any other measurement menu of the WCDMA UE function group using the *Spectrum* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).


Menu Select
WCDMA FDD Spectrum
Connect Control
ACLR Filter
Appli-cation
Analyzer Lev. Trigg
Analyzer Settings
Generator Level
Generator Settings
Menus
Repetition
Stop Condition
Statistic Count
Unit
ACLR Filter
ACLR FFT/OBW
Emission Mask
Max. Level
Mode
Attenuation
High Dynamic
RF Channel
RF Frequency
RF Freq.Offset
Level
DPCH Ch. Code
Pow. Offs. DPCCH
Dedicated Ch. Mode
3GPP DL Refer. Ch.
TPC Pattern
TPC Profile
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

dBm Max. Level: Auto Normal RF Chan./RF Freq. 9612 / 1922.4 MHz
RF Freq. Offset: + 0.000 kHz

2560 chips Meas. Length
9.07 dBm UE Power
10 Statistic Count
0.00 % Out of Tolerance

-10.00 MHz	-5.00 MHz	0 MHz	+5.00 MHz	+10.00 MHz	
-49.3	-47.7	+16.5 dBm	-47.7	-49.6	ACLR Curr (Peak)
-51.3	-50.1	+8.8 dBm	-50.0	-51.1	ACLR Curr (RMS)
-51.4	-50.1	All Values in dB	-49.9	-51.3	ACLR Avg (RMS)
-46.4	-44.4		-44.9	-47.2	ACLR Max (Peak)
-51.2	-49.9		-49.8	-51.1	ACLR Max (RMS)

Fig. 4-27 Measurement menu Spectrum

Test Settings

The *Analyzer Level, Analyzer Settings, Marker* (for application *ACLR FFT/OBW*), and *Menus* test settings are identical with those in the *Power* menu (see section *Test Settings* on page 4.6). The following softkeys and hotkeys differ from the *Power* measurement:

ACLR Filter

The *ACLR Filter* softkey controls the *Spectrum* measurement and indicates its status *(RUN | HLT | OFF).*

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Spectrum* measurement, however, a running measurement is restarted.

Remote control
`INITiate:SPECtrum:MFILter`
`ABORt:SPECtrum:MFILter`

`STOP:SPECtrum:MFILter`
`CONTinue:SPECtrum:MFILter` etc.

Measurement configuration

Pressing the *ACLR Filter* softkey twice opens the popup menu *Spectrum Configuration* (see page 4.53 ff.). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated to the *ACLR Filter* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test Settings* on page 4.6); they are identical with the parameters set in the *Control* tab of the *Spectrum Configuration* menu (see section *Measurement Control (Spectrum Configuration – Control)* on page 4.69 ff.). The *Display Mode* hotkey, which is available in the *ACLR FFT/OBW* application, is also provided in the *Control* tab.

The *ACLR Filter* and *ACLR FFT/OBW* hotkey bars contain an additional hotkey:

Application

The *Application* softkey selects the measurement method for the *Spectrum* measurement and the type of measurement parameters. For a detailed description see background information in section *Spectrum Measurements* on p. 4.58.

The alternative applications call up different measurement menus. The configuration settings for all *Spectrum* applications, however, are listed in a common popup menu (see p. 4.66 ff.).

ACLR Filter

The *ACLR Filter* hotkey selects the measurement of the Adjacent Channel Leakage power Ratio (ACLR) using the direct filter method. This measurement method yields ACLR values at five distinct frequencies (at the carrier frequency, at ±5 MHz and at ±10 MHz from the carrier frequency) that can be showed in a bar graph.

Remote control
The *ACLR Filter* application is selected by the keyword `:MFILter` in the 3rd level of the `Spectrum` commands, e.g. `CONFigure:SPECtrum:MFILter...`

ACLR FFT/OBW

The *ACLR FFT/OBW* hotkey selects the measurement of the Adjacent Channel Leakage power Ratio (ACLR) and of the Occupied Bandwidth (OBW) using the Fast Fourier Transform (FFT) method. This measurement method yields the ACLR as a continuous curve in the a 25 MHz wide frequency range centered around the carrier frequency.

Remote control
The *ACLR FFT/OBW* application is selected by the keyword `:MFFT` in the 3rd level of the `Spectrum` commands, e.g. `CONFigure:SPECtrum:MFFT...`

Emission Mask

The *Emission Mask* hotkey selects the measurement of the spectrum emissions using the Fast Fourier Transform (FFT) method. This measurement method yields the ACLR as a continuous curve in the a 25 MHz wide frequency range centered around the carrier frequency.

Remote control
The *ACLR FFT/OBW* application is selected by the keyword `:MFFT` in the 3rd level of the `Spectrum` commands, e.g. `CONFigure:SPECtrum:MFFT...`

Analyzer Level

The *Analyzer Level* softkey controls the level in the RF input signal path and provides the trigger settings for the *Spectrum* measurement.

Compared to the *Power* measurement, the *Analyzer Level* hotkey bar contains an addtional hotkey:

High Dynamic

The *High Dynamic* hotkey sets the RF input path in such a way that the dynamic range of the *Spectrum* measurement is maximized. The setting is valid for all applications of the *Spectrum* measurement group. It does not overwrite the *Attenuation* setting that remains valid for all other measurement groups. The *Attenuation* setting is also used as long as *High Dynamic* is switched off.

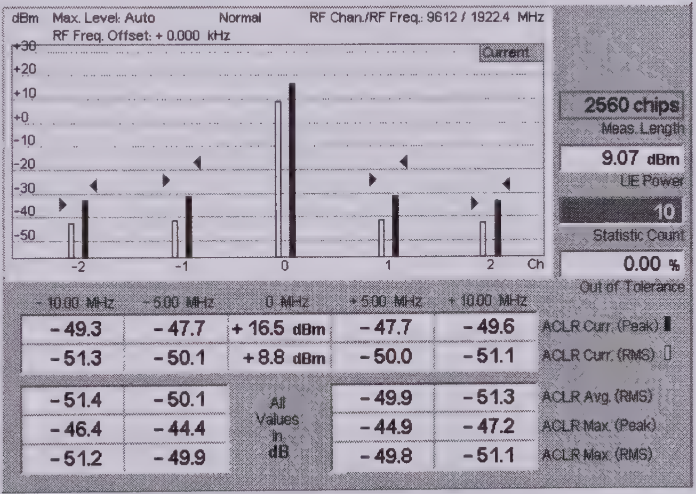
Remote control
`CONFigure:SPECtrum:CONTrol:HDYNamic  ON | OFF`

Measurement Results

The *Spectrum* menu group contains three separate measurement menus corresponding to the three applications *ACLR Filter, ACLR FFT/OBW* and *Emission Mask*. These menus contain different test diagrams.

ACLR Filter Measurement

In the *ACLR Filter* measurement, the (peak and effective) Adjacent Channel Leakage power Ratio ACLR at five distinct frequencies (at the carrier frequency, at ±5 MHz and at ±10 MHz from the carrier frequency) is displayed. The results and the corresponding measurement settings are indicated in two parameter lines, the test diagram (bar graph) and a tabular overview:



Parameter lines

Bar graph and Output fields

Output tables

dBm Max. Level: Auto Normal RF Chan./RF Freq.: 9612 / 1922.4 MHz
RF Freq. Offset: + 0.000 kHz

2560 chips Meas. Length
9.07 dBm UE Power
10 Statistic Count
0.00 % Out of Tolerance

- 10.00 MHz	- 5.00 MHz	0 MHz	+ 5.00 MHz	+ 10.00 MHz	
- 49.3	- 47.7	+ 16.5 dBm	- 47.7	- 49.6	ACLR Curr. (Peak) ▮
- 51.3	- 50.1	+ 8.8 dBm	- 50.0	- 51.1	ACLR Curr. (RMS) ▯
- 51.4	- 50.1	All Values in dB	- 49.9	- 51.3	ACLR Avg. (RMS)
- 46.4	- 44.4		- 44.9	- 47.2	ACLR Max. (Peak)
- 51.2	- 49.9		- 49.8	- 51.1	ACLR Max. (RMS)

Fig. 4-28 Display of results (ACLR Filter)

Parameter lines The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in two parameter lines across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
RF Chan./Freq.	RF channel measured and associated nominal carrier frequency

Output fields

To the right of the diagram, the following results and settings are displayed:

Meas. Length	Time interval measured (number of consecutive chips) as set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.69 f.
UE Power	Average power in the current evaluation period. This value is measured with a wide band filter, so it should be slightly higher than the *ACLR Curr. (RMS)* value of Ch. 0 indicated in the first table below the diagram. The UE Power measurement can be switched off to accelerate the *ACLR Filter* measurement; see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.69 f.
Statistic Count	Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Out of Tolerance	Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Bar graph

The bar graph shows the current *ACLR Peak* (solid bars) and *ACLR RMS* values (contour bars) in channels no. –2 to +2 (see output table below). The values are measured with an RRC filter that has a roll-off $\alpha = 0.22$ and a bandwidth equal to the chip rate. The red triangles indicate the upper relative limits for both quantities as set in the *Spectrum Configuration – Limits* menu (see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.74).

Upper output table

The values in the output tables are measured with an RRC filter that has a roll-off $\alpha = 0.22$ and a bandwidth equal to the chip rate. The upper output table contains the following scalar values:

ACLR Peak/RMS	Peak and average power in the current evaluation period and in channels no. –2 to +2. The central values (carrier powers) are always expressed in absolute units (dBm). The adjacent channel results can be expressed either in absolute units (adjacent channel powers in dBm) or in relative units (ACLR in dB); see *Display Unit* parameter on p. 4.69.

The *ACLR Peak* and *ACLR RMS* values are calculated for all evaluation periods measured and displayed in the upper output table.

Lower output table

The lower output table contains the average values referenced to a statistics cycle (*Average,* see averaging rules in Chapter 3, section *General Settings)* and the peak values of all evaluation periods measured *(Maximum),* calculated from the *Current* results in the upper output table:

ACLR Avg. (RMS)	Average of all ACLR RMS values referenced to the last statistics cycle
ACLR Max. (Peak)	Maximum of all ACLR Peak values in the measurement (=maximum power ever measured)
ACLR Max. (RMS)	Maximum of all ACLR RMS values in the measurement

These statistical results can be expressed either in absolute (dBm) or in relative units (dB); see *Display Unit* parameter on p. 4.69. The relative powers are calculated first for all evaluation periods. From these *Current* relative powers, the statistical results are derived:

$$ACLR\ Avg.\ (RMS)_{rel}^{Ch.n} = ACLR\ Avg.\ (Curr.(RMS)_{rel})^{Ch.n} = ACLR\ Avg. \left(\frac{Curr.(RMS)^{Ch.n}}{Curr.(RMS)^{Ch.0}} \right)$$

$$ACLR\ Max.\ (Peak)_{rel}^{Ch.n} = ACLR\ Max.\ (Curr.(Peak)_{rel})^{Ch.n} = ACLR\ Max. \left(\frac{Curr.(Peak)^{Ch.n}}{Curr.(Peak)^{Ch.0}} \right)$$

$$ACLR\ Max.\ (RMS)_{rel}^{Ch.n} = ACLR\ Max.\ (Curr.(RMS)_{rel})^{Ch.n} = ACLR\ Max. \left(\frac{Curr.(RMS)^{Ch.n}}{Curr.(RMS)^{Ch.0}} \right)$$

Remote control
`READ[:SCALar]:SPECtrum:MFILter:RELative?`
`FETCh[:SCALar]:SPECtrum:MFILter:RELative?`
`SAMPle[:SCALar]:SPECtrum:MFILter:RELative?` etc.

Limit Check

A red output field indicates that the measurement result exceeds the upper relative limits set in the *Limits* tab of the *Spectrum* configuration menu, and that the absolute power in the channel is above the absolute limit set, see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.74.

Remote control
`CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMits?`

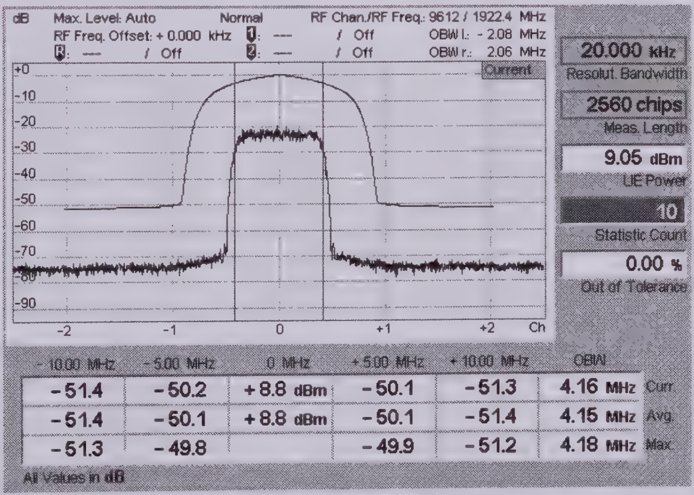
ACLR FFT/OBW Measurement

In the *ACLR FFT/OBW* measurement, the Adjacent Channel Leakage power Ratio ACLR determined by means of the FFT method is plotted as a function of the frequency. A statistical evaluation of the ACLR at different frequencies and of the Occupied Bandwidth (OBW) is displayed in addition. The results and the corresponding measurement settings are indicated in three parameter lines, the test diagram and a tabular overview below:

Parameter lines

Test diagram

Output table



dB Max. Level: Auto Normal RF Chan./RF Freq.: 9612 / 1922.4 MHz
RF Freq. Offset: + 0.000 kHz 1: --- / Off OBW l.: - 2.08 MHz
R: --- / Off 2: --- / Off OBW r.: 2.06 MHz

20.000 kHz Resolut. Bandwidth
2560 chips Meas. Length
9.05 dBm UE Power
10 Statistic Count
0.00 % Out of Tolerance

- 10.00 MHz	- 5.00 MHz	0 MHz	+ 5.00 MHz	+ 10.00 MHz	OBW	
- 51.4	- 50.2	+ 8.8 dBm	- 50.1	- 51.3	4.16 MHz	Curr.
- 51.4	- 50.1	+ 8.8 dBm	- 50.1	- 51.4	4.15 MHz	Avg.
- 51.3	- 49.8		- 49.9	- 51.2	4.18 MHz	Max.

All Values in dB

Fig. 4-29 Display of results (ACLR FFT/OBW)

Settings/ Results

Scalar measurement results and settings are indicated in the three parameter lines above the test diagram and in the output table below.

1st / 2nd Parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in the first and second parameter lines across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

2nd / 3rd parameter line

The second and third parameter lines contain the following marker values and results:

R	Measurement result and frequency (distance from the carrier) of reference marker
1	Measurement result and frequency of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and frequency of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)
OBW left	Lower limit frequency of the Occupied Bandwidth (OBW) calculation: 0.5% of the total integrated power of the spectrum is transmitted in the range below this frequency.
OBW right	Upper limit frequency of the Occupied Bandwidth (OBW) calculation: 0.5% of the total integrated power of the spectrum is transmitted in the range above this frequency.

Output fields

To the right of the diagram, the following settings are displayed:

Resol. Bandwidth	Fixed bandwidth of the resolution filter used to obtain the spectral FFT curve displayed in the diagram from the Fast Fourier Transform data.
Meas. Length	Time interval measured (number of consecutive chips) as set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.69 f.
UE Power	Average power in the current evaluation period, irrespective of the display mode set. This value is measured with a wide band filter, so it should be slightly higher than the *Curr.* value of Ch. 0 indicated in the center of the table below the diagram.
Statistic Count	Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Out of Tolerance	Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Diagram

The lower (blue) continuous curve in the test diagram shows the spectral FFT curve in a 25 MHz wide frequency range centered around the nominal carrier frequency. The display mode for the curve is always *Current*, irrespective of the display mode set. The curve is calculated by means of the FFT method described in section *Spectrum Measurements* on p. 4.58. The fixed y-axis range extends from –80 dB to +10 dB relative to the power at 0 MHz measured with a 3.84 MHz RRC filter *(Ref. Power)*.

The upper (red) continuous curve in the test diagram shows the ACLR calculated from the FFT curve by applying a numerical RRC filter. This numerical method eliminates random effects from the FFT curve transforming it into a smooth curve for which it makes sense to perform a statistical evaluation. Therefore, the display mode (*Current, Maximum, Average*) for this curve is indicated in the upper right corner of the diagram. It can be set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.69 f. The ACLR curve is normalized to the *Ref. Power* by definition, i.e. its central (0 MHz) value is 0 dB.

If the option *OBW Line Display* is activated in the *Control* tab of the configuration menu, the limits *OBW left* and *OBW right* are also indicated as two vertical red lines left and right from the carrier frequency.

Remote control
`READ:ARRay:SPECtrum:MFFT::WFSPectrum:CURRent?`
`FETCh:ARRay:SPECtrum:MFFT::WFSPectrum:CURRent?`
`SAMPle:ARRay:SPECtrum:MFFT::WFSPectrum:CURRent?` etc.

Output table

The output table below the diagram shows the RMS-averaged power at the carrier frequency (Channel 0, central values) and in channels no. ±1 and ±2 as well as the Occupied Bandwidth (OBW). The OBW is the difference between the *OBW left* and *OBW right* values shown in the parameter lines above the diagram.

The values are calculated for all evaluation periods measured and displayed in the upper table row *(Curr.)*. From these *Current* results the average values referenced to a statistics cycle (*Avg.*, see averaging rules in Chapter 3, section *General Settings)* and the peak values of all evaluation periods measured *(Max.)* are calculated.

The central values (carrier powers) are always expressed in absolute units (dBm). The adjacent channel results can be expressed either in absolute units (adjacent channel powers in dBm) or in units relative to the carrier powers (ACLR in dB); see *Display Unit* parameter on p. 4.69.

Remote control
`READ[:SCALar]:SPECtrum:MFFT:RELative?`
`FETCh[:SCALar]:SPECtrum:MFFT:RELative?`
`SAMPle[:SCALar]:SPECtrum:MFFT:RELative?`

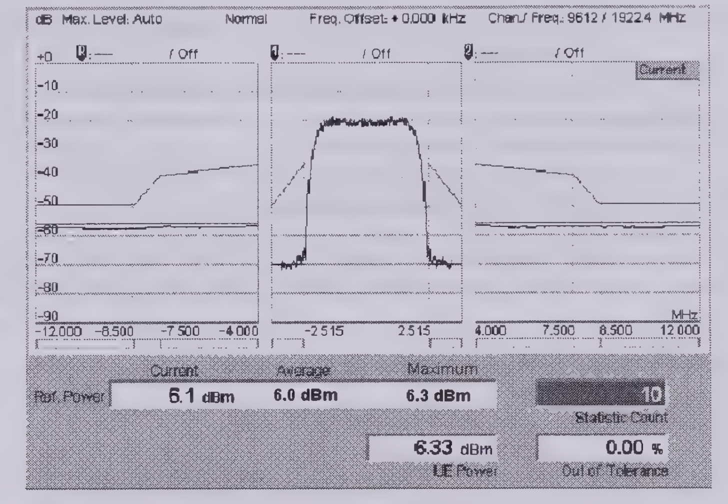
Limit Check

A red output field indicates that the measurement result exceeds the upper relative limits set in the *Limits* tab of the *Spectrum* configuration menu, and that the absolute power in the channel is above the absolute limit set, see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.74.

Remote control
`CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMits?`

Emission Mask Measurement

In the *Emission Mask* measurement, the spectrum emissions are plotted in three diagrams showing the frequency ranges where the bandwidth of the Gaussian resolution filter used to derive the result from the FFT curve is constant. A statistical evaluation of the reference power is displayed in addition. The results and the corresponding measurement settings are indicated in two parameter lines, the three test diagrams and several output fields below:



Parameter lines

Test diagrams

Output fields

dB Max. Level: Auto Normal Freq. Offset: + 0.000 kHz Chan./ Freq.: 9612 / 1922.4 MHz

R: --- / Off 1: --- / Off 2: --- / Off

	Current	Average	Maximum
Ref. Power	6.1 dBm	6.0 dBm	6.3 dBm

Statistic Count: 10

UE Power: 6.33 dBm

Out of Tolerance: 0.00 %

Fig. 4-30 Display of results (Spectrum Emission Mask)

Settings/ Results

Scalar measurement results and settings are indicated in the parameter lines above the test diagram and in the output table below.

1st parameter line

The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in the first parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

2nd parameter line

The second parameter line contains the following marker values and results:

R	Measurement result and frequency (distance from the carrier) of reference marker
1	Measurement result and frequency of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and frequency of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Output fields

To the right of the diagram, the following settings are displayed:

Ref. Power	UE output power measured in a 3.84 MHz bandwidth (reference power). The three output fields show the *Current, Average* and *Maximum* results. The spectrum emission curve is calculated as the ratio of the *Current, Average* or *Maximum* off-carrier power to the *Current, Average* or *Maximum* reference power.
UE Power	Average power in the current evaluation period. This value is measured with a wide band filter, so it should be slightly higher than the *Current* value of the *Ref. Power*.
Statistic Count	Number of evaluation periods per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.

Out of Tolerance	Percentage of evaluation periods where the tolerance limits are exceeded.

Remote control
`READ[:SCALar]:SPECtrum:EMASk?`
`FETCh[:SCALar]:SPECtrum:EMASk?`
`SAMPle[:SCALar]:SPECtrum:EMASk?`

Diagrams

The lower (blue) continuous curve in the test diagram shows the spectrum emissions in three diagrams covering the following frequency ranges:

- Left diagram: frequencies between –12 MHz and –4 MHz from the carrier, obtained with a 1 MHz Gaussian filter
- Central diagram: frequencies between –3.485 MHz and +3.485 MHz from the carrier, obtained with a 30 kHz Gaussian filter
- Left diagram: frequencies between +4 MHz and +12 MHz from the carrier, obtained with a 1 MHz Gaussian filter

The display mode (*Current, Maximum, Average*) for the curves is indicated in the upper right corner of the diagram. It can be set in the *Control* tab of the configuration menu, see section *Measurement Control (Spectrum Configuration – Control)* on p. 4.69 f. The curve is calculated as described in section *Spectrum Measurements* on p. 4.58. The fixed y-axis range extends from –90 dB to +0 dB relative to the *Ref. Power*.

The red curves in the test diagram show the emission mask (limit lines) which can be set in the *Limit Lines* tab of the configuration menu, see section *Emission Mask (Spectrum Configuration – Limit Lines)* on p. 4.71 f.

Remote control
`READ:ARRay:SPECtrum:EMASk:CURRent`,
`FETCh:ARRay:SPECtrum:EMASk:CURRent`,
`SAMPle:ARRay:SPECtrum:EMASk:CURRent` etc.

Limit Check

The two bars below the diagram are divided into several sections corresponding to the fixed limit line areas defined in the standard. If the curve exceeds the limits in an area, the corresponding section of the bars turns red.

Remote control
`CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATCHing:LIMit?`
`CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATCHing:LIMit?`
`CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATCHing:LIMit?`

Measurement Configurations (Spectrum)

The popup menu *Spectrum Configuration* contains three tabs to define the parameters of the *Spectrum* measurement including the error tolerances.

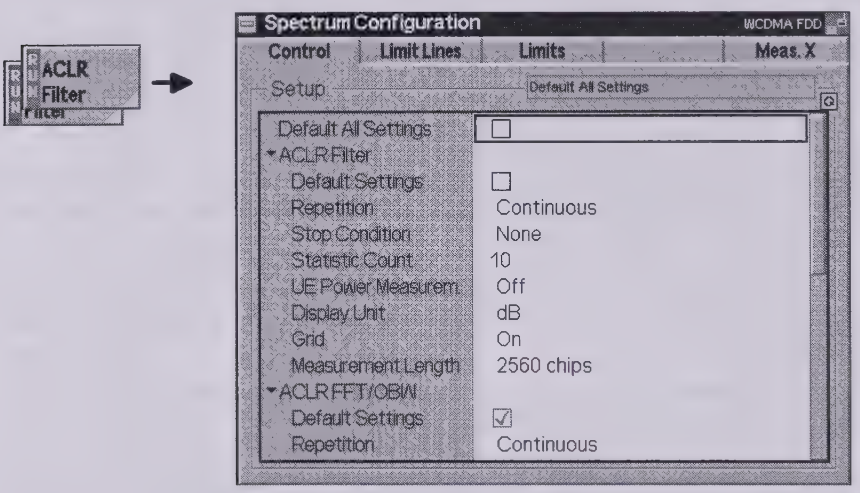
The popup menu *Spectrum Configuration* is called up by pressing the measurement control softkey in the top right of the graphical measurement menu *Spectrum* twice (this softkey reads *ACLR Filter* or *ACLR FFT/OBW*, depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Spectrum Configuration – Control)

The *Control* tab controls the *Spectrum* measurement by defining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The measurement curve displayed *(Display Mode*, for application *ACLR FFT/OBW)*
- The number of slots/evaluation periods forming a statistics cycle *(Statistic Count)*
- The unit for the ACLR values displayed in tables *(Display Unit)*
- The number of chips measured *(Measurement Length*)

Besides, it influences the graphical measurement menus by adding or removing the *Grid* and the OBW line *(OBW Line Display;* for application *ACLR FFT/OBW).*



Default All Settings	☐
▾ACLR Filter	
Default Settings	☐
Repetition	Continuous
Stop Condition	None
Statistic Count	10
UE Power Measurem.	Off
Display Unit	dB
Grid	On
Measurement Length	2560 chips
▾ACLR FFT/OBW	
Default Settings	☑
Repetition	Continuous

Fig. 4-31 Spectrum Configuration – Control

The settings can be defined separately for the different applications of the *Spectrum* measurement group. Most functions comply with those of the *Control* tab of the *Power Configuration* menu (see page 4.18). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `SPECtrum:<Spec_Application>`. The following parameters are specific to the *Spectrum* measurement:

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
`DEFault:SPECtrum:<Spec_Application>:CONTrol ON | OFF`

UE Power Measurem. The *UE Power Measurem.* switches the measurement of the UE Power in the ACLR Filter application on or off. If the measurement is switched off, the UE Power output field shows an invalid result "---" but the whole ACLR Filter measurement is faster.

Remote control
`CONFigure:SPECtrum:MFILter:CONTrol:UEPMeasure ON | OFF`

Display Unit The *Display Unit* parameter selects the display unit for scalar ACLR results. It is possible to select absolute (dBm) or relative units (dB). Switchover to relative units affects the ACLR results for the adjacent channels displayed in the tables below the

ACLR Filter and *ACLR FFT/OBW* diagrams. The diagram scales are not affected. The calculation of relative statistical values is explained in sections *ACLR Filter Measurement* on p. 4.62 and *ACLR FFT/OBW Measurement* on p. 4.64.

Remote control
no explicit switchover command; relative and absolute results can be retrieved with a keyword RELative or ABSolute annexed to the measurement results commands, e.g.:

```
READ[:SCALar]:SPECtrum:MFILter:ABSolute?
READ[:SCALar]:SPECtrum:MFILter:RELative? etc.
```

Measurement Length

The *Measurement Length* parameter selects a time interval (number of consecutive chips) to be measured. The following values are provided:

2560 Chips	The measurement extends over the complete WCDMA slot comprising 2560 chips.
1280 Chips	The measurement extends over half of the WCMDA slot.
640 Chips	The measurement extends over a quarter of the WCMDA slot.
320 Chips	The measurement extends over an eighth of the WCMDA slot.

A short measurement length reduces the measurement time. The position of the time interval measured within the slot is generally not critical for the *Spectrum* results; it depends on the trigger settings:

- In the *Free Run* trigger setting, the position is random.
- In the *External* or *Internal* trigger setting, the position is determined by the external trigger time.

Note that this differs from the *Modulation* measurement where the *Measurement Length* always starts at the beginning of the slot.

Note: *In the ACLR FFT/OBW and Emission Mask applications, the actual measurement length is longer than the selected number of chips. Measurement length settings of 320 chips, 640 chips, 1280 chips, and 2560 chips correspond to actual measurement lengths of 512, 1024, 2048, and 4096 chips, respectively.*

Remote control

```
CONFigure:SPECtrum:<Spec_Application>:CONTrol:MLENgth
  <No_chips>
```

Display Mode

The *Display Mode* hotkey selects one of the following display modes for the measurement curve in the *ACLR FFT/OBW* diagram:

Current	Measured value for current evaluation period
Maximum	Maximum of a number of evaluation periods
Average	Average value of a number of evaluation periods, referenced to a statistics cycle

The calculation of the measurement curves and the rules for averaging is described in Chapter 3, section *General Settings*. No *Display Mode* is available in the *ACLR Filter* application where no measurement curve is displayed.

Remote control
No display mode set explicitly, the three measurement curves are accessible via:

```
FETCh:ARRay:SPECtrum:<Spec_Application>:CURRent?
FETCh:ARRay:SPECtrum:<Spec_Application>:MAXimum?
FETCh:ARRay:SPECtrum:<Spec_Application>:AVERage? etc.
```

OBW Line Display

The *OBW Line Display* switches the indication of the limit frequencies *OBW left* and *OBW right* in the *ACLR FFT/OBW* diagram on or off. The two values are indicated by two vertical red lines. The frequency difference *OBW right – OBW left* is equal to the Occupied Bandwidth (OBW).

Remote control
No remote configuration, screen configuration only.

Emission Mask (Spectrum Configuration – Limit Lines)

The *Limit Lines* tab defines relative and absolute upper limits for the spectrum emissions.

Conformance requirements

The energy that spills outside the designated radio channel increases the interference with adjacent channels and decreases the system capacity.

According to the 3GPP standard, the amount of unwanted off-carrier energy is assessed by the Occupied Bandwidth (OBW) and the out of band emission (excluding spurious emissions) that are specified in terms of a spectrum emission mask and Adjacent Channel Leakage power Ratio (ACLR). The OBW and ACLR limits are defined in the *Limits* tab; see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.74. The spectrum emission mask is specified as follows:

Table 4-5 3GPP spectrum emission mask

Frequency offset from carrier Δf	**Minimum requirement**	**Additional requirement for band II**	**Measurement bandwidth**
2.5 MHz to 3.5 MHz	–35 dBc – 15*(Δf/MHz – 2.5) dBc	–15 dBm	30 kHz[1]
3.5 MHz to 7.5 MHz	–35 dBc – 1*(Δf/MHz – 3.5) dBc	–13 dBm	1 MHz[2]
7.5 MHz to 8.5 MHz	–39 dBc – 10*(Δf/MHz – 7.5) dBc	–13 dBm	1 MHz[2]
8.5 MHz to 12.5 MHz	–49 dBc	–13 dBm	1 MHz[2]

Note 1: *The first and last measurement position with a 30 kHz filter is 2.515 MHz and 3.485 MHz.*

Note 2: *The first and last measurement position with a 1 MHz filter is 4 MHz and 12 MHz.*

Note 3: *The limit specifications in Table 4-5 above only apply if the power in the measured frequency range exceeds the absolute limit of –50 dBm referenced to a 3.84 MHz filter. This implies that the absolute spectrum emissions must be:*

- *above* $-50\ \text{dBm} + 10\cdot\log_{10}\left(\frac{1}{3.84}\right)\ \text{dBm} \approx -55.8\ \text{dBm}$ *where they are measured with a 1 MHz filter,*
- *above* $-50\ \text{dBm} + 10\cdot\log_{10}\left(\frac{0.03}{3.84}\right)\ \text{dBm} \approx -71.1\ \text{dBm}$ *where they are measured with a 30 kHz filter.*

Signals with smaller powers always pass the entire limit check.

The complete spectrum emission mask is (for band II) shown in *Fig. 4-32 below.*

EINBETTEN

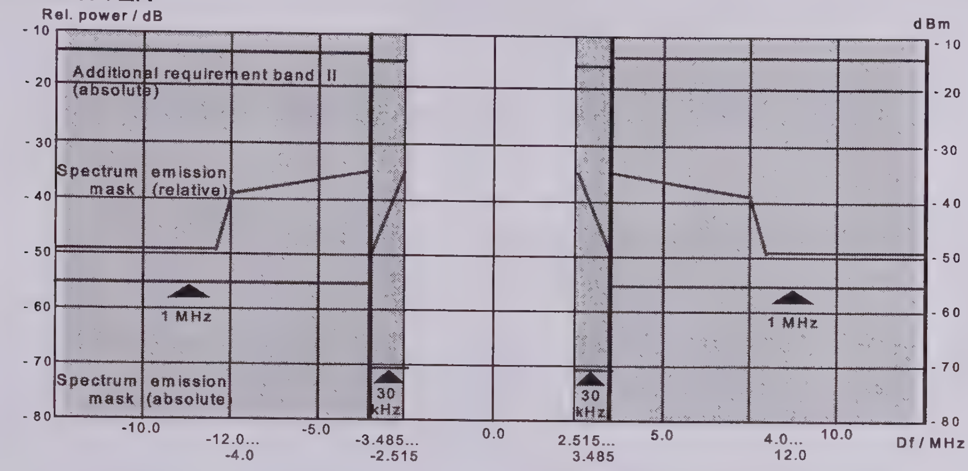
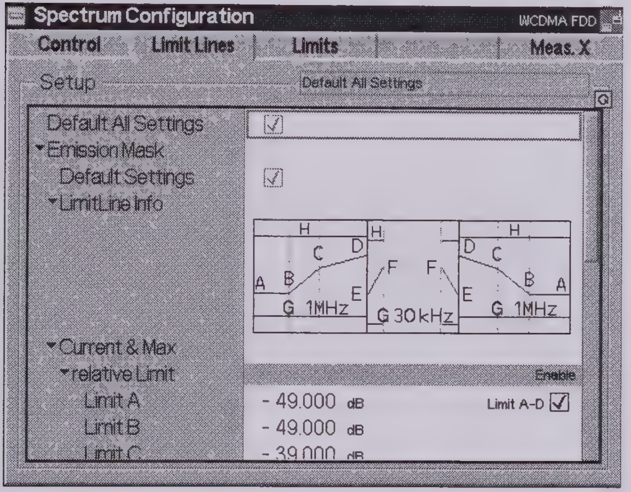


Fig. 4-32 Spectrum emission mask

ACLR
Filter
Filter



Setup: Default All Settings

Default All Settings ☑

Emission Mask

Default Settings ☑

LimitLine Info

Current & Max

relative Limit — Enable

Limit A - 49.000 dB — Limit A-D ☑

Limit B - 49.000 dB

Limit C - 39.000 dB

Fig. 4-33 Spectrum Configuration – Limits

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Limit Lines* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
`DEFault:SPECtrum:EMASk:LIMit:LINE ON | OFF`

Limit Line Info The *Limit Line Info* diagram shows a preview of the spectrum emission mask that represents a simplified version of *Fig. 4-32*. According to the specification, the relative limit lines consist of several line sections with different slopes. In the CMU the line sections are defined by the coordinates of their start and end points labeled A to F. In contrast, the absolute limit lines of the CMU are defined by three values corresponding to the filter bandwidths 3.84 MHz, 1 MHz and 30 kHz (sections G).

Current & Max. The *Current & Max* table section diagram defines relative and absolute limits for the *Current* and for the *Maximum* spectrum emission curve. All limits are symmetric to the carrier frequency

The upper *relative Limits* are given by the start and end points of the individual line sections. These points are located at fixed frequencies:

Limit A	Start point of section 1, corresponding to a frequency of ±12 MHz from the carrier
Limit B	End point of section 1 and start point of section 2, corresponding to a frequency of ±8.5 MHz from the carrier
Limit C	End point of section 2 and start point of section 3, corresponding to a frequency of ±7.5 MHz from the carrier
Limit D	End point of section 3 corresponding to a frequency of ±4 MHz from the carrier
Limit E	Start point of section 4, corresponding to a frequency of ±3.845 MHz from the carrier
Limit F	End point of section 4 corresponding to a frequency of ±2.515 MHz from the carrier
Enable	Switches the relative limit check in sections 1 to 3 (1 MHz filter, *Limit A-D)* or in section 4 (30 kHz filter, *Limit E-F)* **including the absolute limit check** G and H on or off

The *absolute Limit G* is defined by the 3.84 MHz reference value. From this value, the 1 MHz and 30 kHz limits are calculated according to the formulas of Note 3 on p. 4.71.

Limit G, 3.84 MHz	Reference value for the absolute limit for the UE carrier frequency measured with a 3.84 MHz RRC filter. This value is used to calculate all absolute limits of the spectrum emission mask. It is not correlated to the absolute level that can be set in the *Limits* tab; see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.74 ff.
Limit G, 1 MHz	Absolute limit for the spectrum emission in the frequency domain where it is measured with a 1 MHz Gaussian filter, corresponding to the current 3.84 MHz reference value (not editable, grayed).
Limit G, 30 kHz	Absolute limit for the spectrum emission in the frequency domain where it is measured with a 30 kHz Gaussian filter, corresponding to the current 3.84 MHz reference value (not editable, grayed).
Enable	Switches the absolute limit check of limit G on or off

The *absolute Limit H* is defined in the 1 MHz and 30 kHz frequency domains. This limit corresponds to the *Additional requirement for band II* in *Table 4-5* and is not used in the other frequency bands. If a measurement result exceeds the absolute limit H, the domain is out of tolerance, irrespective of the result of the relative limit check.

Note: *In realistic test scenarios, the limit G is always smaller than the limit H. Results smaller than G are passed, results larger than H are failed.*

Remote control

```
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:SYMmetric:
          [COMBined]:VALue
CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:SYMmetric:
          [COMBined]:VALue
CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE
          :SYMMetric:[COMBined]:VALue
```

Priority and

Under normal operating conditions, the relative limit check represents the critical indication of limit checks

criterion because the absolute check is a secondary condition which a WCDMA UE is very likely to fulfil. Consequently, the CMU deactivates the absolute limit check if the relative limit check is entirely switched off. In the measurement diagram, the absolute limit lines are indicated only if both the relative and the absolute limit checks are active.

Average

The *Average* table section diagram defines relative and absolute limits for the *Average* spectrum emission curve. The settings are analogous to the Current & Max. settings described above.

Remote control

```
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:
         SYMmetric:[COMBined]:VALueCONFigure:SPECtrum:EMASk:AB
Solute:AVERage:LIMit:LINE:
         SYMmetric:[COMBined]:VALue
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE
         :SYMMetric:[COMBined]:VALue
```

Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)

The tab *Limits* defines upper limits for the parameters of the *Spectrum* measurement.

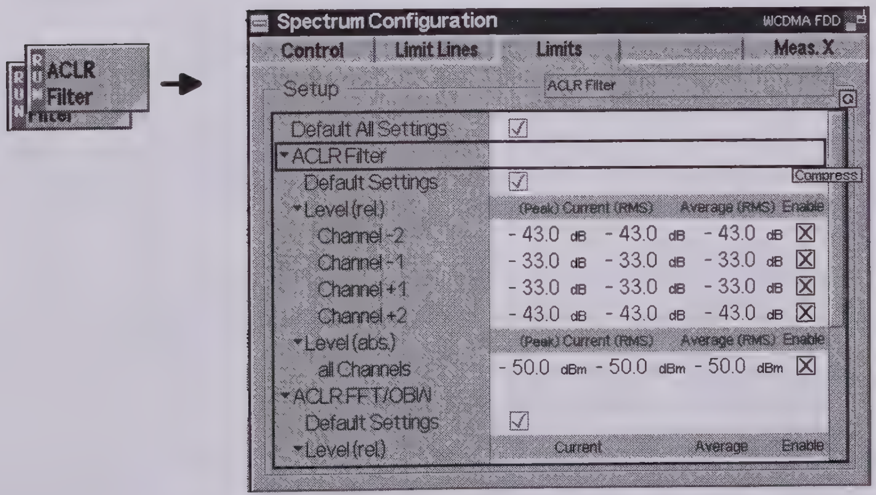
Conformance requirements

The energy that spills outside the designated radio channel increases the interference with adjacent channels and decreases the system capacity.

According to the 3GPP standard, the amount of unwanted off-carrier energy is assessed by the Occupied Bandwidth (OBW) and the out of band emission (excluding spurious emissions) that are specified in terms of a spectrum emission mask and Adjacent Channel Leakage power Ratio (ACLR). The spectrum emission mask is defined in the *Limit Lines* tab; see section *Emission Mask (Spectrum Configuration – Limit Lines)* on p. 4.71. The OBW and ACLR limits are specified as follows:

For both power class 3 and power class 4 UE, the ACLR shall not exceed –33 dB at frequencies ±5 MHz from the carrier (channels ±1) and –43 dB at frequencies ±10 MHz from the carrier (channels ±2)[3]. The limits must be met if the adjacent channel power is larger than –50 dBm (absolute limit); they must hold even in the presence of switching transients.

For the OBW, an upper limit of 5 MHz based on a chip rate of 3.84 MHz is specified.



Default All Settings	☑			
ACLR Filter				
Default Settings	☑			
Level (rel.)	(Peak) Current (RMS)		Average (RMS)	Enable
Channel -2	- 43.0 dB	- 43.0 dB	- 43.0 dB	☒
Channel -1	- 33.0 dB	- 33.0 dB	- 33.0 dB	☒
Channel +1	- 33.0 dB	- 33.0 dB	- 33.0 dB	☒
Channel +2	- 43.0 dB	- 43.0 dB	- 43.0 dB	☒
Level (abs.)	(Peak) Current (RMS)		Average (RMS)	Enable
all Channels	- 50.0 dBm	- 50.0 dBm	- 50.0 dBm	☒
ACLR FFT/OBW				
Default Settings	☑			
Level (rel.)	Current		Average	Enable

Fig. 4-34 Spectrum Configuration – Limits

---

[3] To keep our results in line with networks like GSM and TDMA, we define the ACLR and the limits with a relative minus sign compared to the 3GPP standard. The role of upper and lower limits is accordingly interchanged.

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:SPECtrum:MFILter:LIMit <Enable>
DEFault:SPECtrum:MFFT:LIMit <Enable>
```

ACLR Filter

The *ACLR Filter* table section defines upper limits for the ACLR measured with the direct filter method. The following relative values *Level (rel.)* can be set for channels ±1 (at ±5 MHz from the carrier) and ±2 (at ±10 MHz from the carrier):

Curr.&Max (Peak)	Upper limit for the peak ACLR of the current evaluation period (first table row in the upper table of the *ACLR Filter* menu)
Curr.&Max (RMS)	Upper limit for the effective ACLR of the current evaluation period (second table row in the upper table of the *ACLR Filter* menu)
Average (RMS)	Upper limit for the average of all *Current (RMS)* values referenced to the last statistics cycle (first table row in the lower table of the *ACLR Filter* menu)
Enable	Switches the limit check in the corresponding channel on or off

The absolute limits *Level (abs.)* are the powers in dBm below which no relative limit check needs to be performed. Common absolute limits for all channels can be set in the *All channels table section.*

Remote control

```
CONFigure:SPECtrum:MFILter:RPEak:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:RRMS:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:RRMS:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:RELative:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:Enable <Enable>
CONFigure:SPECtrum:MFILter:APEak:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:ARMS:CURRent:LIMit[:SCALar]:
        ASYMmetric:UPPer:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:ARMS:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFILter:ABSolute:LIMit[:SCALar]:
        ASYMmetric:UPPer:Enable <Enable>
```

ACLR FFT/OBW

The *ACLR FFT/OBW* table section defines upper limits for the ACLR measured with the FFT method and for the OBW. The following relative values *Level (rel.)* can be set for the ACLR in channels ±1 (at ±5 MHz from the carrier) and ±2 (at ±10 MHz from the carrier) and for the OBW:

Curr.&Max	Upper limit for the ACLR or OBW of the current slot (first table row in the output table of the *ACLR FFT/OBW* menu)
Average	Upper limit for the average of all *Current* values referenced to the last statistics cycle (second table row in the output table of the *ACLR FFT/OBW* menu)
Enable	Switches the limit check in the corresponding channel (or for OBW) on or off

The absolute limits *Level (abs.)* are the powers in dBm below which no relative limit check needs to be performed. Common absolute limits for all channels can be set in the *All channels table section.*

Remote control

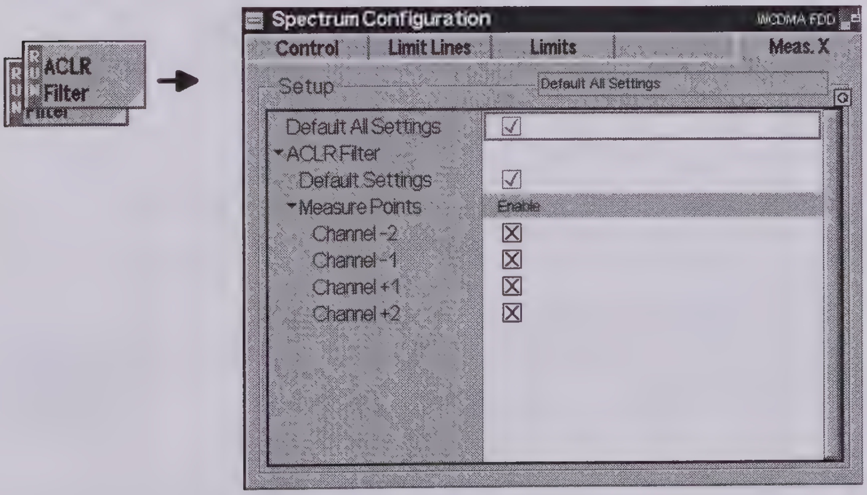
```
CONFigure:SPECtrum:MFFT:RELative:CMAX:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:RELative:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer:CHANnel<nr>:VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:RELative:LIMit[:SCALar]:ASYMmetric:UP
Per:    CHANnel<nr>:Enable <Enable>
CONFigure:SPECtrum:MFFT:ABSolute:CMAX:LIMit[:SCALar]:
        ASYMmetric:UPPer: VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:ABSolute:AVERage:LIMit[:SCALar]:
        ASYMmetric:UPPer: VALue <ACLR_Limit>
CONFigure:SPECtrum:MFFT:ABSolute:LIMit[:SCALar]:
        ASYMmetric:UPPer:Enable <Enable>
```

Priority and indication of limit checks

Under normal operating conditions, the relative limit check represents the critical criterion because the absolute check is a secondary condition which a WCDMA UE is very likely to fulfil. Consequently, the CMU deactivates the absolute limit check if the relative limit check is switched off. The limit markers in the *ACLR Filter* measurement diagram show the relative limit check.

Selection of Measurement Points (Spectrum Configuration – Meas. X)

The tab *Meas. X* determines at which channels/frequencies a *ACLR Filter* measurement is performed.



Default All Settings ☑
ACLR Filter
Default Settings ☑
Measure Points Enable
Channel -2 ☒
Channel -1 ☒
Channel +1 ☒
Channel +2 ☒

Fig. 4-35 Spectrum Configuration – Meas. X

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Meas. X* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications (at present, the *ACLR Filter* application) are provided.

Remote control

```
DEFault:SPECtrum:MFILter:MEASx <Enable>
```

Measure Points

The *Measure Points* table section enables (*Enable* box checked) or disables the spectrum measurement on individual channels. Channels ±1 (at ±5 MHz from the carrier) and ±2 (at ±10 MHz from the carrier) can be selected. A reduction of the measurement points enhances the measurement speed.

Remote control
`CONFigure:SPECtrum:MFILter:MEASx:CHANnel<nr>:ENABle <Enable>`

Code Domain Power Measurements

The menu group *Code Domain Power* comprises the functions for measurement of the relative power and the waveform quality (ρ factor) in the individual code or physical channels of an uplink WCDMA signal. The measurement results are displayed in the graphical measurement menu *Code Domain Power,* the popup menu *Code Domain Power Configuration* is used for configuration of the measurements.

The *Code Domain Power* measurement serves to assess the average power and the modulation accuracy in each code channel. This is done by means of two different quantities:

CDP	The Code Domain Power (CDP) is the ratio of the power in an individual code channel to the power of the composite WCDMA signal, expressed in dB.
CD-ρ	The CD-ρ factor is the correlated power (ρ factor) of an individual channel divided by the total power of the composite WCDMA signal. It is calculated in analogy to the waveform quality for the whole signal (see *Equation 4-3* on p. 4.33), but with the measured signal vector Z_k replaced by the measured signal vector in the code channels. The waveform quality for the whole signal approaches 1 as the signal approaches the ideal signal. Analogously, the CD-ρ factor, which is a measure for the modulation accuracy of an individual code channel signal, approaches 1/<number of code channels> as the code channel signal approaches the ideally modulated signal. For an ideal WCDMA uplink signal comprising 1 DPCCH plus 6 DPDCHs, the CD-ρ factor of all physical channels is 1/7 ≈ 0.142.

The quantities CDP and CD-ρ can be displayed in two alternative ways:

- In the code channel representation (applications *CDP ... Auto)*, the CDP and CD-ρ factor of the I and Q signal are displayed in two separate bar graphs as a function of the channelization code. The channelization codes are determined assuming a symbol rate and power threshold as set in the *Auto Settings* section in the *UE Code* tab of the *Connection Control* menu.
- In the physical channel representation (applications *CDP ... Manual)*, the CDP and CD-ρ factor are displayed in a single bar graph as a function of the physical channels contributing to the WCDMA signal (DPCCH, DPDCH1,..., DPDCH6). The symbol rates and channelization codes must be set in the *Manual Settings* section in the *UE Code* tab of the *Connection Control* menu.

For WCDMA standard uplink signals, both representations are equivalent as the I/Q phase and the channelization code uniquely defines the physical channel and vice versa; see *Fig. 4-13* on p. 4.34. The measurement speed in *Manual* mode, however, is higher than in *Auto* mode. On the other hand, the *Auto* measurements represent the more universal applications. They can be used if the channelization codes or the symbol rate of the analyzed signal are unknown, e.g. because the signal configuration does not conform to 3GPP specifications or because the UE transmitter uses non-standard channelization codes.

A limit check is provided in the physical channel representation only, because it is more conveniently visualized in the corresponding diagram.

Measurement Menu (Code Domain Power)

The graphical measurement menu *Code Domain Power* displays the results of the code domain power and waveform quality measurement.

- The measurement control softkey *CDP/Code Auto* (which changes to *CDP/Code Manual, CDP/Code Rho Auto* or *CDP/Code Rho Manual*, if one of these applications is selected) controls the measurement, indicates its status *(RUN | HLT | OFF)* and opens the configuration menu *Code Domain Power Configuration.* The hotkeys associated to the measurement control softkey define the scope of the *Code Domain Power* measurement.
- The softkeys *Application, Analyzer Level, UE Code/Analyzer Set., Marker* and *Menus* to the right of the test diagram are combined with various hotkeys. The softkey/hotkey combinations provide test settings and switch over between different measurements. The entry of values is described in section *Measurement Menu (Power)* on page 4.5.

The measurement menu *Code Domain Power* can be accessed from any other measurement menu of the WCDMA UE function group using the *Code Domain Power* hotkey. It can be opened also from the *Menu Select* main menu (with the associated key at the front of the instrument).

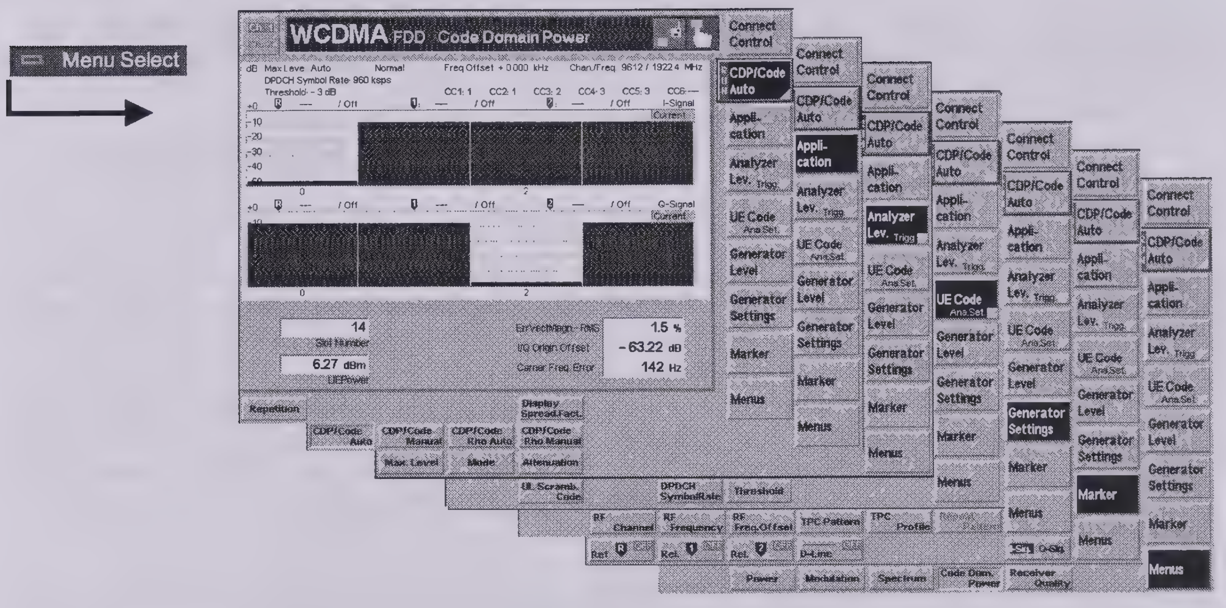

Menu Select
WCDMA FDD Code Domain Power
Connect Control
CDP/Code Auto
Appli-cation
Analyzer Lev. Trigg
UE Code Ana.Set.
Generator Level
Generator Settings
Marker
Menus
14 Slot Number
6.27 dBm UEPower
Err.Vect.Magn. - RMS 1.5 %
I/Q Origin Offset -63.22 dB
Carrier Freq. Error 142 Hz
Repetition
CDP/Code Auto
CDP/Code Manual
CDP/Code Rho Auto
CDP/Code Rho Manual
Display Spread.Fact.
Max. Level
Mode
Attenuation
UL Scramb. Code
DPDCH SymbolRate
Threshold
RF Channel
RF Frequency
RF Freq.Offset
TPC Pattern
TPC Profile
Ref.
D-Line
I-Sig Q-Sig
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

Fig. 4-36 Measurement menu Code Domain Power

Test Settings

The *Analyzer Level* test settings and the *Menus* functions are identical with those in the *Power* menu (see section *Test Settings* on page 4.6). The same holds for the *Marker* functions. In the *CDP/Code Auto* and *CDP Rho Auto* applications, where the I and Q signal components are displayed in two separate diagrams, two marker sets are available. They are activated by pressing the *I-Sig Q-Sig* toggle switch.

The following softkeys and hotkeys differ from the other measurements:

CDP/Code Auto

The *CDP/Code Auto* softkey controls the *Code Domain Power* measurement of the WCDMA signal with automatic search of the channelization codes and indicates its status *(RUN | HLT | OFF)*.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Code Domain Power* measurement; however, a running measurement is restarted.

Remote control
`INITiate:CDPower:AUTomatic`
`ABORt:CDPower:AUTomatic`
`STOP:CDPower:AUTomatic`
`CONTinue:CDPower:AUTomatic` etc.
`FETCh:CDPower:AUTomatic:STATus?`

Measurement configuration

Pressing the *CDP/Code Auto* softkey twice opens the popup menu *Code Domain Power Configuration* (see page 4.53 ff.). Besides, the hotkeys *Repetition, Stop Condition,* and *Statistic Count* defining the scope of the measurement are associated to the *CDP/Code Auto* softkey. The function of these hotkeys is explained in the *Power* menu section (see section *Test Settings* on page 4.6); they are identical with the parameters set in the *Control* tab of the *Code Domain Power*

Configuration menu (see section *Measurement Control (Code Domain Power Configuration – Control)* on page 4.69 ff.). The *Display Mode* hotkey, which is available in the *CDP ... Manual* applications, is also provided in the *Control* tab.

Display Spread.Fact.

The *Display Spread. Fact.* hotkey selects the number of code channels to be displayed in the *CDP/Code Auto* and *CDP/Code Rho Auto* applications.

Remote control

```
CONFigure:CDPower:<CDP_Auto_Application>:CONTrol:DSFactor
  <Factor>
```

Application

The *Application* softkey selects the measurement method for the *Code Domain Power* measurement and the type of measurement parameters. For a detailed description see background information in section *Code Domain Power Measurements* on p. 4.78.

The alternative applications call up different measurement menus containing bar graphs and various output fields; see section *Measurement Results* on p. 4.82 ff. The configuration settings for all *Code Domain Power* applications, however, are listed in a common popup menu (see section *Measurement Configurations (Code Domain Power)* on p. 4.87 ff.).

CDP/Code Auto

The *CDP/Code Auto* hotkey selects the measurement of the Code Domain Power (CDP) of all code channels. This measurement method yields the relative WCDMA transmit power at up to 256 different channelization codes.

Remote control
The *CDP/Code Auto* application is selected by the keywords
`:CDPower:AUTomatic` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:AUTomatic...`

CDP/Code Manual

The *CDP/Code Manual* hotkey selects the measurement of the power in the dedicated physical channels contributing to the uplink WDCMA signal analyzed. This measurement method yields the relative WCDMA transmit power in one DPCCH and up to 6 DPDCHs.

Remote control
The *CDP/Code Auto* application is selected by the keywords `:CDPower:MANual` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g.
`CONFigure:CDPower:MANual...`

CDP/Code Rho Auto

The *CDP/Code Rho Auto* hotkey selects the measurement of the normalized correlated power (ρ factor) of all code channels. This measurement method yields the ρ factor at up to 256 different channelization codes.

Remote control
The *CDP/Code Rho Auto* application is selected by the keywords
`:CDPower:RAUTomatic` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:RAUTomatic...`

CDP/Code Rho Manual

The *CDP/Code Rho Manual* hotkey selects the measurement of the normalized correlated power (ρ factor) in the dedicated physical channels contributing to the uplink WDCMA signal analyzed. This measurement method yields the ρ factor in one DPCCH and up to 6 DPDCHs.

Remote control
The *CDP/Code Rho Auto* application is selected by the keywords

`:CDPower:RMANual` in the 2nd and 3rd level of the *Code Domain Power* commands, e.g. `CONFigure:CDPower:RMANual...`

UE Code
Ana. Set.

The *UE Code* softkey defines the properties of the multiple uplink WCDMA signal that the CMU is able to analyze. For a description of the WCDMA signal see background information in section *Measurement Menu (Modulation – WCDMA)* on page 4.45 f. The UE Code settings are also accessible via the *UE Code* tab of the *Connection Control* menu; see *section Uplink Signal (Connection Control – UE Code)* on p. 6.127 ff.

The hotkeys associated to the UE Code softkeys depend on the selected application:

- In the *CDP ... Auto* applications, the WCDMA signal is analyzed in the channelization code domain. The CMU searches for the DPDCH channelization codes assuming a definite scrambling code, DPDCH symbol rate, and power threshold. In this mode, the *UL Scrambling Code, DPDCH Symbol Rate* and *Threshold* hotkeys are available.
- In the *CDP ... Manual* applications, the WCDMA signal is analyzed in the physical channel domain. The CMU analyzes the signal from the WCDMA UE assuming definite symbol rates and channelization codes. In this mode, the *Multiple Signal* configuration, the *UL Scrambling Code* and the symbol rate and channelization codes *(Sym. Rate Chan. Code)* can be set.

If pressed once again, the selected *UE Code* softkey changes to the *Analyzer Settings* softkey, see section *Test Settings* on page 4.6.

Note: *In Signalling mode, there is no need to set the* UE Code *parameters* Multiple Signal, DPDCH CC Mode, Sym. Rate/Chan. Code. *The parameters are implicitly included in the dedicated channel settings. The* UL Scrambling Code *that the UE shall use can be set in the* UE Signal *tab and doesn't have to be configured at the UE.*

UL Scramb.
Code

The *UL Scramb. Code* hotkey selects the number of the long code that is used to scramble the WCDMA signal. The scrambling code number must be in the range 0 to FFFFFF (hex), corresponding to 0 to 16777215 decimal. The measurement fails if the input signal does not conform to the *Scrambling Code* settings.

The scrambling code setting is valid for both the *CDP ... Auto* and the *CDP ... Manual* applications.

Remote control
`CONFigure:UECode:DPCH:SCODe <Code>`

The following hotkeys are not available (and the settings are ignored) in the *CDP ... Auto* applications; see above, *UE Code* softkey.

Multiple
Signal

The hotkey *Multiple Signal* selects the physical channels that contribute to the multiple uplink WCDMA signal.

DPCCH	Signal consists of one single Dedicated Physical Control Channel
DPCCH+DPDCH1,...n	Signal consists of one DPCCH to which n Dedicated Physical Data Channels are added. n can vary between 1 and 6 so that it is possible to superimpose up to 7 signals as shown in *Fig. 4-13* on p. 4.34.

Remote control
`CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>`

Sym. Rate Chan. Code

The *Sym. Rate Chan. Code* hotkey calls up a list of the symbol rate and channelization code for the DPCCH and each of the six CPDCHs that can contribute to the multiple WCDMA signal. If a *DPCCH+DPDCH1* multiple signal is analyzed, the symbol rate of the data channel *DPDCH1* can be set. The channelization code will be automatically adapted according to the rules in the 3GPP standard. For other multiple signal configurations, symbol rates and channelization codes are fixed.

Remote control
`CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Rate>,<Code>`

The following hotkeys are not available (and the settings are ignored) in the *CDP ... Manual* applications; see above, *UE Code* softkey. They are explained in more detail in section *Uplink Signal (Connection Control – UE Code)* on p. 6.127 ff.

DPDCH Sym. Rate

The *DPDCH Symbol Rate* hotkey selects the symbol rate of the DPDCH.

Remote control
`CONFigure:UECode:DPDCh:AUTO:SRATe <Rate>`

Threshold

The *Threshold* hotkey defines a mimimum signal strength of each DPDCH_n in the WCDMA signal to be detected in the automatic channelization code search.

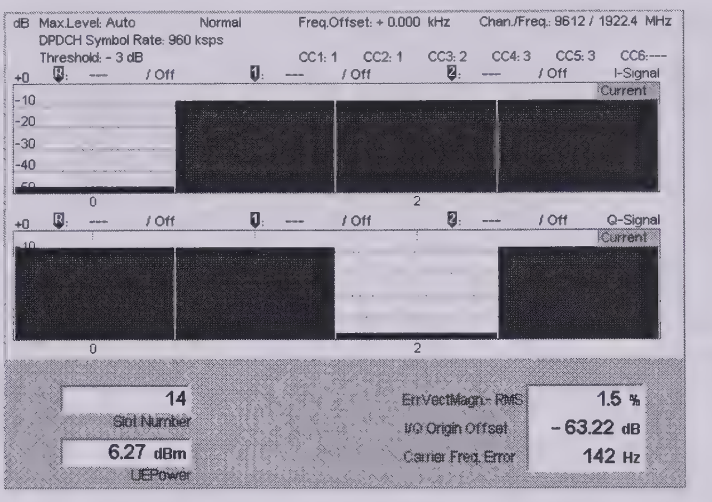
Remote control
`CONFigure:UECode:DPDCh:AUTO:THReshold <Threshold>`

Measurement Results

The *Code Domain Power* menu group contains four separate measurement menus corresponding to the four applications *CDP/Code Auto, CDP/Code Manual, CDP/Code Rho Auto* and *CDP/Code Rho Manual*. The menus in the two *Auto* applications are analogous to each other but differ from the *Manual* menus.

CDP/Code Auto and CDP/Code Rho Auto

In the *CDP/Code Auto (CDP/Code Rho Auto)* measurement, the relative transmit power (normalized correlated power or ρ factor) is projected onto all code channels of the WCDMA signal. The results and the corresponding measurement settings are indicated in four parameter lines, two test diagrams (one bar graph for the I and Q signal component) and several output fields:



Parameter lines

I-Signal bar graph

Q-Signal bar graph

Output fields

dB Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz
DPDCH Symbol Rate: 960 ksps
Threshold: - 3 dB CC1: 1 CC2: 1 CC3: 2 CC4: 3 CC5: 3 CC6:---

R: --- / Off 1: --- / Off 2: --- / Off I-Signal

R: --- / Off 1: --- / Off 2: --- / Off Q-Signal

Slot Number: 14
UEPower: 6.27 dBm
ErrVectMagn.- RMS: 1.5 %
I/Q Origin Offset: - 63.22 dB
Carrier Freq. Error: 142 Hz

Fig. 4-37 Display of results (CDP/Code Auto)

Parameter lines The essential analyzer settings (as set via the *Analyzer Level* softkey described on p. 4.8 and the *Analyzer Settings* softkey described on p. 4.8) are indicated in a parameter line across the top of the measurement menu:

Max. Level	Maximum expected input level in dBm
Attenuation	Setting for the internal attenuation of the input level *(Normal, Low Noise, Low Distortion)*
Freq. Offset	Frequency offset with respect to the nominal WCDMA channel frequency
Chan./Freq.	RF channel measured and associated nominal carrier frequency

The two lines below indicate the properties of the measurement and of the analyzed WCDMA signal as defined by means of the *UE Code* softkey (see p. 4.47) and/or in the *UE Code* tab of the *Connection Control* menu; see section *Uplink Signal (Connection Control – UE Code)* on p. *6.127* ff.:

Multiple Signal	Physical channels that contribute to the WCDMA signal
Sync. Mode	Synchronization between the WCDMA signal and the CMU: *All Slots Scr. Code* Scrambling code number of the WCDMA signal
CCn	Channelization codes of the data channels DPDCH$_1$ to DPDCH$_6$

4th parameter line The fourth parameter line contains the following marker values and results:

R	Measurement result and code channel of reference marker
1	Measurement result and channel of delta marker 1 (setting *absolute*) or difference from reference marker (setting *relative*)
2	Measurement result and channel of delta marker 2 (setting *absolute*) or difference from reference marker (setting *relative*)

Remote control
The settings are read out using the query corresponding to the setting command (setting command with appended question mark).

Bar graphs The bar graphs in the *CDP/Code Auto (CDP/Code Rho Auto)* measurement menu show the relative WCDMA transmit power (normalized correlated power or ρ factor) of the current slot, projected to the individual code channels of the WCDMA signal. The number of code channels and thus the width of the individual bars and the x-axis scale can vary between 4 and 256 (in powers of 2), depending on the *Display Spreading Factor* selected in the *Control* tab of the configuration menu (see section *Measurement Control (Code Domain Power Configuration – Control)* on p. 4.87 f. The results for the I and Q components of the signal are displayed in two separate diagrams.

The values are measured with an RRC filter that has a roll-off $\alpha = 0.22$ and a bandwidth equal to the chip rate. The y-axis scale of the diagrams is fixed: The results for the *CDP/Code Auto* measurement are expressed in dB units relative to the total power of the multiple WCDMA signal, also measured with an RRC filter. The ρ factors determined in the *CDP/Code Rho Auto* application are dimensionless numbers that can vary between 0 and 1/<number of code channels>. No limit check is performed.

For a standard uplink WCDMA signal, the DPCCH is always assigned to channelization code 0 (actually $C_{256,0}$) of the Q-signal. This code is not used by any data channel, so it is possible to represent the DPCCH plus the data channels in a common bar graph irrespective of the *Display Spreading Factor* and the actual spreading factor of the analyzed signal. *Fig. 4-37 above* shows a standard uplink WCDMA signal with one DPCCH plus 5 DPDCHs.

Remote control
`READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?`
`READ:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?` etc.

Output fields

Below the diagram, the following timing, power and modulation parameters are displayed:

Slot Number	Number of the measured slot of the captured signal within the 10 ms frame and in the range 0 to 14.
UE Power	Average power in the current evaluation period, irrespective of the display mode set.

The modulation parameters displayed in the output fields on the right side are explained in section *Measurement of Modulation Parameters* on p. 4.30. They are also displayed and monitored in the *CDP...* measurement menus to show a possible relation between the modulation accuracy and the code domain parameters (e.g. poor modulation accuracy may result in noise or non-orthogonal components that are detected as fictitious channels).

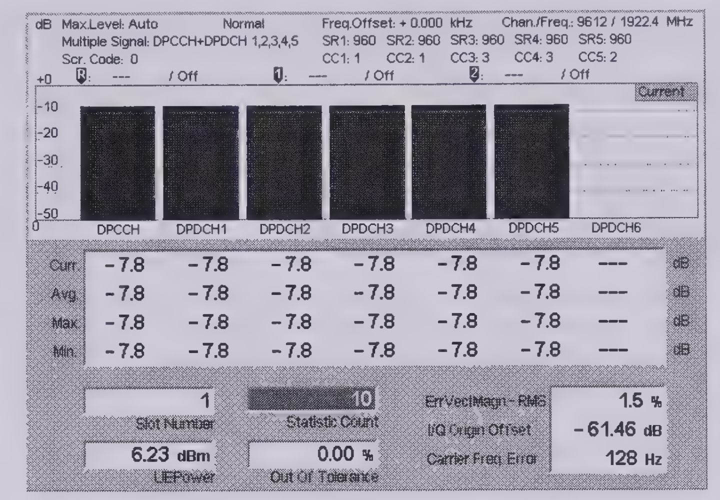
Err. Vect. Magn.	Error Vector Magnitude (EVM) RMS averaged over the current slot
I/Q Origin Offset	Origin offset in the I/Q constellation diagram
Carrier Freq. Err.	Difference between measured and expected (nominal) signal frequency

The modulation parameters are not limit-checked.

Remote control
`READ[:SCALar]:CDPower:AUTomatic?`
`READ[:SCALar]:CDPower:RAUTomatic?`

CDP/Code Manual and CDP/Code Rho Manual

In the *CDP/Code Manual (CDP/Code Rho Manual)* measurement, the relative transmit power (normalized correlated power or ρ factor) is projected onto all physical channels (DPCCH plus up to 6 DPDCHs) contributing to the uplink WDCMA signal. The results and the corresponding measurement settings are indicated in four parameter lines, the test diagram, an output table and several output fields:



Parameter lines

Test diagram

Output table

Output fields

dB Max.Level: Auto Normal Freq.Offset: + 0.000 kHz Chan./Freq.: 9612 / 1922.4 MHz
Multiple Signal: DPCCH+DPDCH 1,2,3,4,5 SR1: 960 SR2: 960 SR3: 960 SR4: 960 SR5: 960
Scr. Code: 0 CC1: 1 CC2: 1 CC3: 3 CC4: 3 CC5: 2
R: --- / Off 1: --- / Off 2: --- / Off

	DPCCH	DPDCH1	DPDCH2	DPDCH3	DPDCH4	DPDCH5	DPDCH6	
Curr.	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	---	dB
Avg.	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	---	dB
Max.	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	---	dB
Min.	-7.8	-7.8	-7.8	-7.8	-7.8	-7.8	---	dB

Slot Number: 1
Statistic Count: 10
UEPower: 6.23 dBm
Out Of Tolerance: 0.00 %
ErrVectMagn - RMS: 1.5 %
I/Q Origin Offset: -61.46 dB
Carrier Freq. Error: 128 Hz

Fig. 4-38 Display of results (CDP/Code Manual)

Parameter lines The test settings and results (marker values) displayed in the four parameter lines are analogous to settings and results in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see section *CDP/Code Auto and CDP/Code Rho Auto* on p. 4.82.

Bar graph The bar graph in the *CDP/Code Manual (CDP/Code Rho Manual)* measurement menu shows the relative WCDMA transmit power (normalized correlated power or ρ factor) projected to all dedicated physical channels (DPCCH plus up to 6 DPDCHs) contributing to the uplink WDCMA signal. The values depend on the display mode *(Current, Average, Maximum or Minimum)* that can be set in the *Control* tab of the configuration menu (see section *Measurement Control (Code Domain Power Configuration – Control)* on p. 4.87 f. The display mode is indicated in the upper right corner of the diagram.

The x-axis is fixed: It is labeled by the Dedicated Physical Control Channel (DPCCH) and the Dedicated Physical Data Channels no. 1 to 6 (DPDCH1 to DPDCH6). If the WCDMA signal contains less than 6 data channels (see *Multiple Signal* softkey on p. 4.81), the corresponding bars are omitted.

The values are measured with an RRC filter that has a roll-off α = 0.22 and a bandwidth equal to the chip rate. The y-axis scale of the diagram is fixed: The results for the *CDP/Code Manual* measurement are expressed in dB units relative to the total power of the multiple WCDMA signal measured with the same RRC filter. The ρ factors determined in the *CDP/Code Rho Manual* application are dimensionless numbers that can vary between 0 and 1/<number of physical channels>.

Remote control
`READ:ARRay:CDPower:MANual:CURRent?` ,
`READ:ARRay:CDPower:MANual:AVERage?`
`READ:ARRay:CDPower:MANual:MAXimum?`
`READ:ARRay:CDPower:MANual:MINimum?` etc.

Limit Check The pairs of horizontal red lines in the diagram represent the limit lines set in the *Limits* tab of the configuration menu; see section *Tolerance Values (Code Domain Power Configuration – Limits)* on p. 4.88 f.

Remote control
`CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?`
`CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?`

Output table

The output table below the diagram shows the relative transmit power (or the ρ factor, depending on the application) in all dedicated physical channels (DPCCH plus up to 6 DPDCHs) contributing to the uplink WDCMA signal.

The values are calculated for all measured channels in the current slot and displayed in the upper table row *(Curr.)*. From these *Current* results the average values referenced to a statistics cycle (*Avg.,* see averaging rules in Chapter 3, section *General Settings)* and the maximum and minimum values of all slots measured *(Max., Min.)* are calculated.

All remarks concerning the physical units of the bar graphs remain valid: The *CDP/Code Manual* results are expressed in dB units, the ρ factors determined in the *CDP/Code Rho Manual* application are dimensionless numbers.

Remote control
`READ[:SCALar]:CDPower:MANual?`
`READ[:SCALar]:CDPower:RMANual?` etc.

Limit Check

A red output field indicates that the measurement result exceeds the upper limit set in the *Limits* tab of the *Code Domain Power* configuration menu, see section *Tolerance Values for ACLR and OBW (Spectrum Configuration – Limits)* on p. 4.74.

Remote control
`CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?` etc.

Output fields

The slot number, power and modulation parameters below the diagram are equivalent to the parameters in the *CDP/Code Auto (CDP/Code Rho Auto)* menus; see section *CDP/Code Auto and CDP/Code Rho Auto* on p. 4.82. The following additional statistical quantities are displayed:

Statistic Count	Number of slots per statistics cycle. The colored bar indicates the relative measurement progress in the statistics cycle.
Out of Tolerance	Percentage of slots where the tolerance limits are exceeded.

Remote control
`READ[:SCALar]:CDPower:MANual?`
`READ[:SCALar]:CDPower:RMANual?` etc.

Measurement Configurations (Code Domain Power)

The popup menu *Code Domain Power Configuration* contains two tabs that define the parameters of the CDP measurement including the error tolerances.

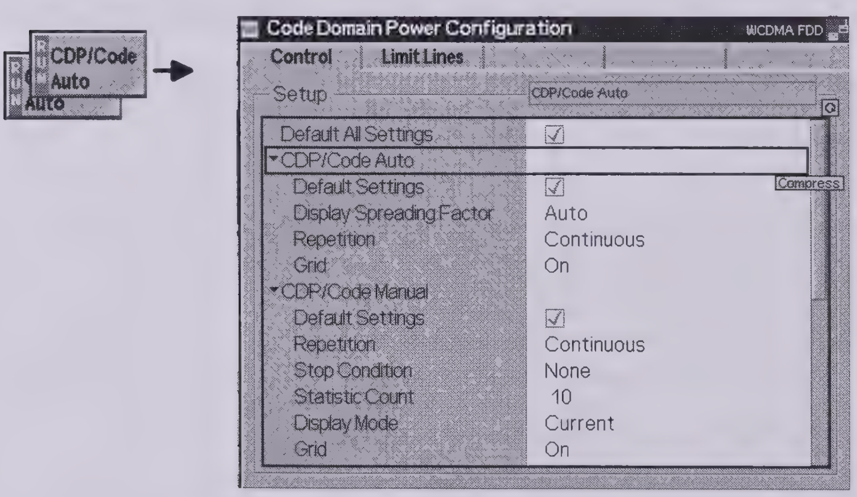
The popup menu *Code Domain Power Configuration* is called up by pressing the measurement control softkey in the top right of the graphical measurement menu *Code Domain Power* twice (this softkey reads *CDP/Code Auto* etc., depending on the selected application). By pressing the associated hotkeys, it is possible to change between the tabs.

Measurement Control (Code Domain Power Configuration – Control)

The *Control* tab controls the *Code Domain Power* measurement by defining

- The number of code channels displayed *(Display Spreading Factor,* for *CDP/Code Auto* and *CDP/Code Rho Auto* measurements)
- The *Repetition* mode
- The measurement curve displayed *(Display Mode*, for applications *CDP/Code Manual* and *CDP/Code Rho Manual)*
- The *Stop Condition* and the number of slots/evaluation periods forming a statistics cycle *(Statistic Count,* for applications *CDP/Code Manual* and *CDP/Code Rho Manual)*

Besides, it influences the graphical measurement menus by adding or removing the *Grid* (for applications *CDP/Code Auto* and *CDP/Code Rho Auto).*



Setup	CDP/Code Auto
Default All Settings	☑
▾CDP/Code Auto	
Default Settings	☑
Display Spreading Factor	Auto
Repetition	Continuous
Grid	On
▾CDP/Code Manual	
Default Settings	☑
Repetition	Continuous
Stop Condition	None
Statistic Count	10
Display Mode	Current
Grid	On

Fig. 4-39 Code Domain Power Configuration – Control

The settings can be defined separately for the different applications of the *Code Domain Power* measurement group. Most functions comply with those of the *Control* tab of the *Power Configuration* menu (see page 4.18). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `CDPower:<CDP_Application>`. The following parameters are specific to the *Code Domain Power* measurement:

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Control* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control
`DEFault:CDPower:<CDP_Application>:CONTrol ON | OFF`

Display Spreading Factor

The *Display Spreading Factor* field selects the number of code channels within the WCDMA signal that are displayed in the *CDP/Code Auto* and *CDP/Code Rho Auto* diagrams.

Auto	The CMU analyzes the uplink signal from the WCDMA UE, determines its DPDCH symbol rate and derives the spreading factor (= chip rate / symbol rate). It projects the signal onto all possible channelization codes, calculates and displays the results.
SF	Change to the arbitrary spreading factor from the DPDCH symbol rate (= chip rate/ spreading factor) in the range between 4 and 256 and in powers of 2.

The *CDP/Code...Auto* measurements will also work if the actual spreading factor of the displayed signal (see section *Measurement Menu (Modulation – WCDMA)* on p. 4.45) differs from the *Display Spreading Factor* set.

Remote control

```
CONFigure:CDPower:<CDP_Auto_Application>:CONTrol:DSFactor
  AUTomatic | 4 | 8 | 16 | 32 | 64 | 128 | 256
```

Display Mode

The *Display Mode* hotkey selects one of the following display modes for the *CDP ... Manual* diagrams:

Current	Measured value for current slot
Minimum	Minimum of a number of slots
Maximum	Maximum of a number of slots
Average	Average value of a number of slots, referenced to a statistics cycle

The calculation of the measurement curves and the rules for averaging is described in Chapter 3, section *General Settings*. No *Display Mode* is available in the *CDP ... Auto* diagrams.

Remote control

No display mode set explicitly, the four measurement curves are accessible via:

```
READ:ARRay:CDPower:MANual:CURRent?
READ:ARRay:CDPower:MANual:AVERage?
READ:ARRay:CDPower:MANual:MAXimum?
READ:ARRay:CDPower:MANual:MINimum? etc.
```

Tolerance Values (Code Domain Power Configuration – Limits)

The tab *Limits* defines upper and lower limits for the code domain power and the code domain ρ factor. The limits are defined for the physical channel representation (applications *CDP/Code Manual* and *CDP/Code Rho Manual)*. However, this doesn't mean a restriction because of the correspondence between physical channels and code channels.

CDP limits

To be detected by the 3GPP Node B, the signal level in every physical and code channel contributing to the WCDMA signal must exceed a certain minimum threshold. In addition, the code domain power is defined relative to the total power of the signal, so none of the individual CDP contributions can be larger than 0 dB.

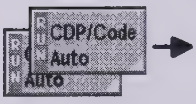
For realistic WCDMA signals, the code domain power is therefore restricted to a range of values that can be defined by an upper and lower limit.

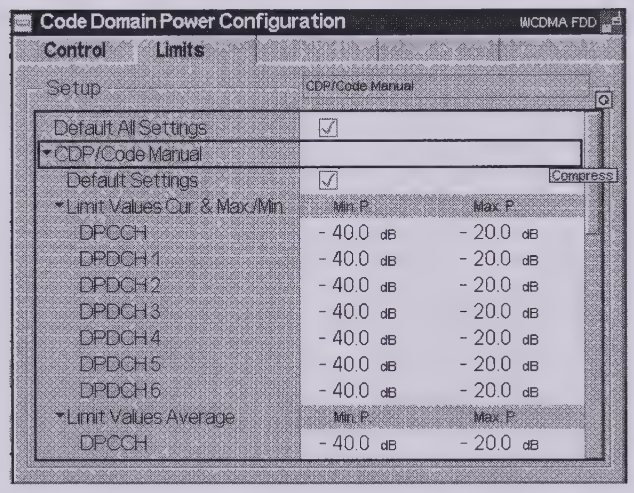
CDP Rho limits

As shown in section *Code Domain Power Measurements* on p. 4.78, the CD-ρ factor is equivalent to the CDP for a WCDMA signal with ideal modulation characteristics:

$$CDP_{ideal} = 10 \cdot \log_{10}\left(CD\rho_{ideal}\right)\ ; \qquad \text{(Equation 4)}$$

For signals with reasonable modulation accuracy, CDP and the CD-ρ factor will still be closely related. This means that it makes sense to impose upper and lower limits to the CD-ρ factors of the individual physical channels that are derived from the CDP limits according to *Equation 4.*





Setup	CDP/Code Manual	
Default All Settings	☑	
CDP/Code Manual		
Default Settings	☑	
Limit Values Cur. & Max./Min.	Min. P.	Max. P.
DPCCH	- 40.0 dB	- 20.0 dB
DPDCH 1	- 40.0 dB	- 20.0 dB
DPDCH 2	- 40.0 dB	- 20.0 dB
DPDCH 3	- 40.0 dB	- 20.0 dB
DPDCH 4	- 40.0 dB	- 20.0 dB
DPDCH 5	- 40.0 dB	- 20.0 dB
DPDCH 6	- 40.0 dB	- 20.0 dB
Limit Values Average	Min. P.	Max. P.
DPCCH	- 40.0 dB	- 20.0 dB

Fig. 4-40 Code Domain Power Configuration – Limits

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Limits* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual applications are provided.

Remote control

```
DEFault:CDPower:MANual:LIMit <Mode>
DEFault:CDPower:RMANual:LIMit <Mode>
```

CDP/Code Manual

The *CDP/Code Manual* table section defines upper and lower limits for the code domain power. Separate values can be defined for the *Current, Maximum* and *Minimum (Curr.&Max./Min.)* and for *Average* results. The following values can be set for all physical channels that may contribute to the WCDMA signal:

Min. P.	Lower limit for the CDP in dB
Max. P.	Upper limit for the CDP in dB

Remote control

```
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CDP_Limit>
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CDP_Limit>
CONFigure:CCDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CDP_Limit>
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CDP_Limit>
```

CDP/Code Rho Manual

The *CDP/Code Rho Manual* table section defines upper and lower limits for the CD-ρ factor. Separate values can be defined for the *Current, Maximum* and *Minimum (Curr.&Max./Min.)* and for *Average* results. The following values can be set for all physical channels that may contribute to the WCDMA signal:

Min. Rho	Lower limit for the ρ factor
Max. Rho	Upper limit for the ρ factor

Remote control

```
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CD-ρ_Limit>
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CD-ρ_Limit>
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:
        UPPer:CHANnel<nr> <CD-ρ_Limit>
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:
        LOWer:CHANnel<nr> <CD-ρ_Limit>
```

Receiver Quality Measurements

The menu group *Receiver Quality* (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, and CMU-B68/CMU-U68, *Layer 1 Board for WCDMA*) tests the transmission performance on the complete signal path from the CMU to the UE under test and back. To this end the UE is set to test loop operation where it returns the received data blocks back to the tester. The measurement is especially suitable to assess the characteristics and the performance of the UE receiver at low RF power levels. UE test loops and bit error rates for conformance tests are specified in standard TS 34.109.

The popup menu *Receiver Quality Configuration* is used to configure the measurements; the measurement results and the most important test settings are indicated in the main menu *Receiver Quality*.

Principle of the BER and BLER measurement

The *Receiver Quality* measurement is based on a comparison of the output signal of the CMU with the signal received and decoded by the UE under test. To this end, the UE must return the received signal to the CMU in loop back mode. Because of the higher signal level, transmission errors produced on the way back (from the UE to the CMU) can usually be neglected.

Standard TS 34.109 specifies the functional behavior of the UE in two different test loop modes and defines scenarios for receiver quality tests (see *Table 4-6 below*). As a high-speed production tester the CMU uses a method of measurement that provides the BER and BLER results (plus an additional DBLER, see below) in parallel. The *WCDMA (3GPP/FDD, DL) Generator* (option CMU-K66) provides a reference measurement channel with variable information bit rate *(Reference Channel Type)* and test data pattern *(Channel Data Source)*. The UE must be set to operate in test loop mode 2 and with either symmetric or asymmetric DL/UL block size. The method of measurement corresponds to the scenario in the shaded cell in *Table 4-6*.

Note: *In Non Signalling mode, the CMU can receive data only if the uplink TFCI sent by the UE indicates a non-empty DTCH. The CMU expects the TFCI assignment in Table 4-11 on p. 4.122, i.e. a TFCI of 1 or 3. The Receiver Quality measurement fails if the UE uses another TFCI, even though the looped-back uplink signal may be correct.*

In Signalling mode, the TFCI assignment in the downlink and uplink is identical, so the CMU automatically receives a valid TFCI.

UE Report

A second *Receiver Quality* application displays a selection of measurement results provided by the UE and transferred in the UE measurement report message. This *UE Report* application requires a connection between the R&S CMU and the UE and is available in *Signalling* test mode only.

Note: *A comprehensive measurement example for* Receiver Quality *tests in* Non Signalling *mode is reported in Chapter 2. Receiver Quality measurements are considerably simplified in* Signalling *mode; see Table 4-19 on p. 4.141.*

Table 4-6 UE test loop modes according to TS 34.109

	Test loop mode 1	**Test loop mode 2**
Loopback point	Above layer 2	Effectively on transport layer (higher layers in Transparent Mode)
Data looped back	RLC/PDCP SDUs	Transport block data and CRC bits
Block size	DL block size = UL block size (symmetric) or DL block size ≠ UL block size (asymmetric)	UL transport block ≥ DL transport block + DL CRC (otherwise UL transport block truncated)

	Test loop mode 1	**Test loop mode 2**
Specified test scenarios	BER test in RLC Transparent Mode (TM) and on 12.2 kbps 3GPP reference measurement channel at symmetric DL/UL block size –> Receiver characteristics BLER test in RLC Acknowledged Mode (AM) and on 64, 144 or 384 kbps ref. measurement channel at symmetric or asymmetric DL/UL block size –> Receiver performance	BLER test on 12.2, 64, 144 or 384 kbps 3GPP reference measurement channel at symmetric or asymmetric DL/UL block size, but with UL transport block ≥ DL transport block + DL CRC –> Receiver performance Test scenario used by the CMU for BER, BLER, and DBLER tests.

Definition of measured quantities

The Bit Error Rate *(BER,* sometimes also termed Bit Error Ratio) is the ratio of bit errors in the data part of the transport block to the total number of transferred data bits in percent:

BER = Data bit errors / total number of data bits * 100%

The BER can be obtained with any (symmetric or asymmetric) DL/UL transport block configuration; see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.93 ff.

The Block Error Rate (BLER, sometimes also termed Block Error Ratio) is the ratio of data blocks that contain bit errors in their data or CRC field to the total number of transferred blocks in percent:

BLER = Blocks with erroneous data or CRC fields / total number of blocks * 100%

To obtain the BLER on the CMU, the UE must use an asymmetric DL/UL transport block configuration; see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.93 ff.

The Data Block Error Rate (DBLER) is the ratio of data blocks that contain bit errors in their data field (excluding the CRC) to the total number of transferred blocks in percent:

DBLER = Blocks with erroneous data fields / total number of blocks * 100%

The DBLER can be obtained with any (symmetric or asymmetric) DL/UL transport block configuration; see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.93 ff. It is generally a good approximation to the BLER; see below.

Relation between BER, BLER and DBLER

The BER, BLER and DBLER are independent quantities characterizing the quality of the UE receiver. It is instructive, however, to consider a simple stochastic model where the BLER and DBLER are both determined by the BER and the transport block size. This model relies on the following approximations:

1. The probability for a bit error is the same for all bits in a transport block, including the CRC; it is therefore equal to the BER.
2. Additional effects due to channel coding and imperfect interleaving are negligible.

Consider a transport block with k data bits and (n – k) CRC bits so that the total number of bits in the block is n. The BLER and DBLER can be calculated as follows:

$$\begin{aligned}\text{BLER} &= 1 - \langle\text{Probability that all bits are correct}\rangle \\ &= 1 - \langle\text{Probability that 1 bit is correct}\rangle^n = 1 - (1 - \text{BER})^n\end{aligned}$$

$$\begin{aligned}\text{DBLER} &= 1 - \langle\text{Probability that all bits are correct}\rangle \\ &= 1 - \langle\text{Probability that 1 bit is correct}\rangle^k = 1 - (1 - \text{BER})^k\end{aligned}$$

Conclusions and Example

In this approximation it is obvious that BLER > DBLER for 0 < BER < 1 and that DBLER = BLER = 0 for BER = 0 and DBLER = BLER = 1 for BER = 1. The relation between the three quantities for the transport block size of the 12.2 kbps 3GPP reference measurement channel (n = 260, k = 244) is plotted in *Fig. 4-41 below.*

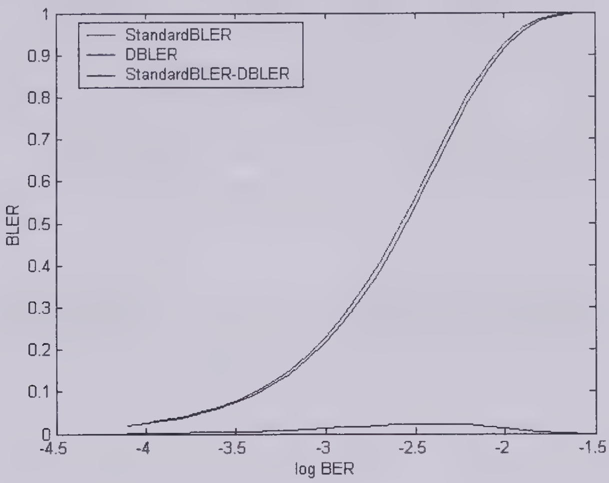


Fig. 4-41 Approximate relation between BER, BLER and DBLER

Test Loops for BER, BLER and DBLER Tests

The Block Error Rate (BLER) and the Data Block Error Rate (DBLER) can both be obtained with test loop scenario 2 of the UE but with a different DL/UL transport block configuration (parameter *DL/UL Transport Block Size* on p. 4.102).

1. Symmetric DL/UL transport blocks (–> DBLER, BER)

The DBLER can also be obtained in a simplified test loop configuration with symmetric (equal) DL/UL block size. The UL CRC is enabled, so the UE attaches a new (correct) UL CRC to the UL transport block. This means that the simple CRC check doesn't provide any reliable information on the BLER.

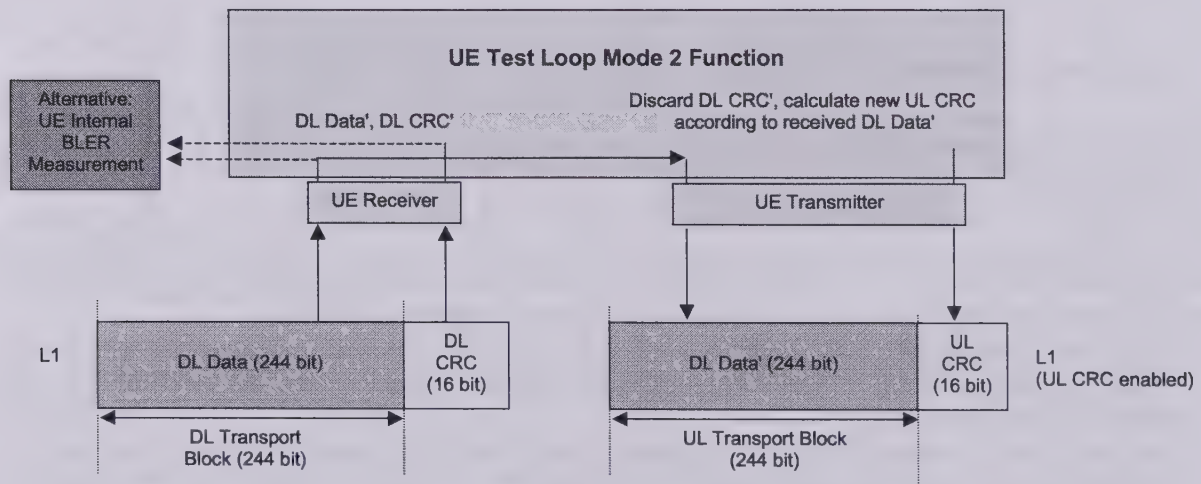

UE Test Loop Mode 2 Function
Alternative: UE Internal BLER Measurement
DL Data', DL CRC'
Discard DL CRC', calculate new UL CRC according to received DL Data'
UE Receiver
UE Transmitter
L1
DL Data (244 bit)
DL CRC (16 bit)
DL Transport Block (244 bit)
DL Data' (244 bit)
UL CRC (16 bit)
L1 (UL CRC enabled)
UL Transport Block (244 bit)

Fig. 4-42 Symmetric DL/UL transport block size for a 12.2 kbps reference meas. channel

To determine the Data Block Error Rate (DBLER) the CMU checks whether the UE had to change the CRC; i.e. whether the CRC of the retransmitted DL Data' (= UL CRC) is equal to the DL CRC, and divides the number of detected data block errors by the total number of transferred blocks. In addition the CMU compares the data bits retransmitted to the original data bits to obtain the BER. Alternatively, the two results plus the BLER can be obtained in an additional UE internal BLER measurement.

2. Asymmetric DL/UL transport blocks (–> BLER, DBLER, BER)

The test loop and DL/UL transport block configuration for the BLER measurement is described in standard TS 34.109. The UE must use an asymmetric DL/UL block size. The UL transport size must be bigger or equal to the sum of DL transport block size and number of CRC bits. The UL CRC is disabled. The DL CRC' (including a possible error produced in the UE receiver) is incorporated into the UL transport block and received by the tester.

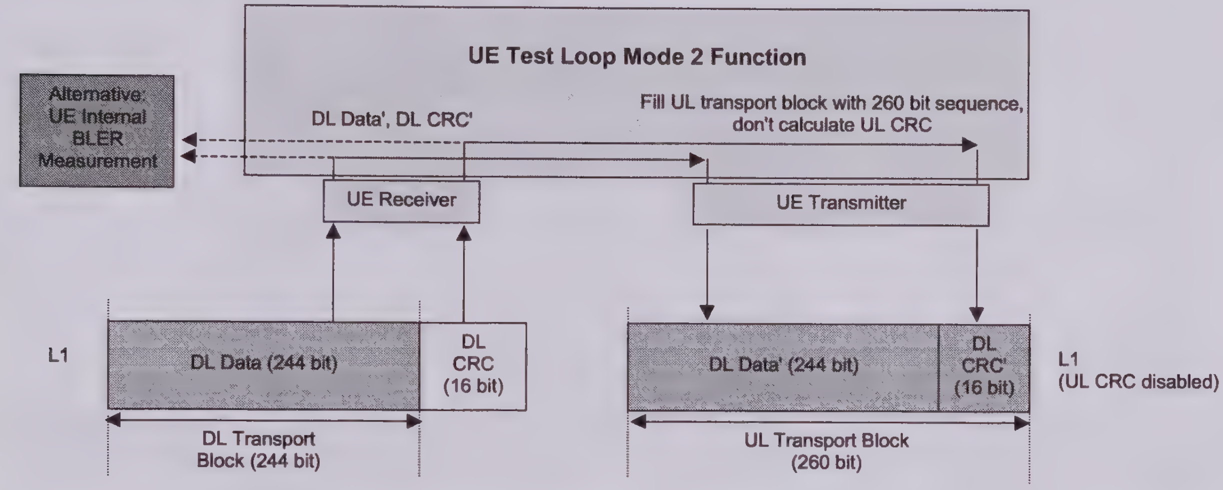

UE Test Loop Mode 2 Function
Alternative: UE Internal BLER Measurement
DL Data', DL CRC'
Fill UL transport block with 260 bit sequence, don't calculate UL CRC
UE Receiver
UE Transmitter
L1
DL Data (244 bit)
DL CRC (16 bit)
DL Transport Block (244 bit)
DL Data' (244 bit)
DL CRC' (16 bit)
L1 (UL CRC disabled)
UL Transport Block (260 bit)

Fig. 4-43 Asymmetric DL/UL transport block size for a 12.2 kbps reference meas. channel

To determine the Block Error Rate (BLER) the CMU checks whether the received and retransmitted DL CRC' matches the retransmitted DL Data' and divides the number of detected block errors by the total number of transferred blocks. In addition the CMU directly compares the data bits retransmitted to the original data bits to obtain the BER and DBLER. Alternatively, all results can be obtained in an additional UE internal BLER measurement.

3. Asymmetric RMC data rate (–> DBLER, BER)

Receiver Quality tests at high data rates are to ensure that the UE receiver performance does not deteriorate under stress conditions. With asymmetric RMCs, the BER and DBLER can be measured even if the UE does not support high data rates in the uplink.

The number of information bits per RMC transport block increases with the data rate. Assume that the DL data rate corresponds to N + n information bits per block, the smaller UL data rate to N information bits per block. Out of the N + n received bits, the UE loops back N bits plus a new UL CRC. Based on the UL information bits, the *Receiver Quality* test results are calculated as follows:

- The Bit Error Rate (BER) is the ratio of the number of bit errors in the retransmitted data bits divided by the total number of retransmitted bits. Assuming statistical independence of the bit errors this ratio is equal to the BER of all DL bits.
- The Data Block Error Rate (DBLER) is calculated as the ratio of the number of UL data blocks with bit errors to the total number of transferred blocks. The smaller UL block size means that this result is a lower limit for the DBLER that would be obtained by evaluating all N + n received DL bits.

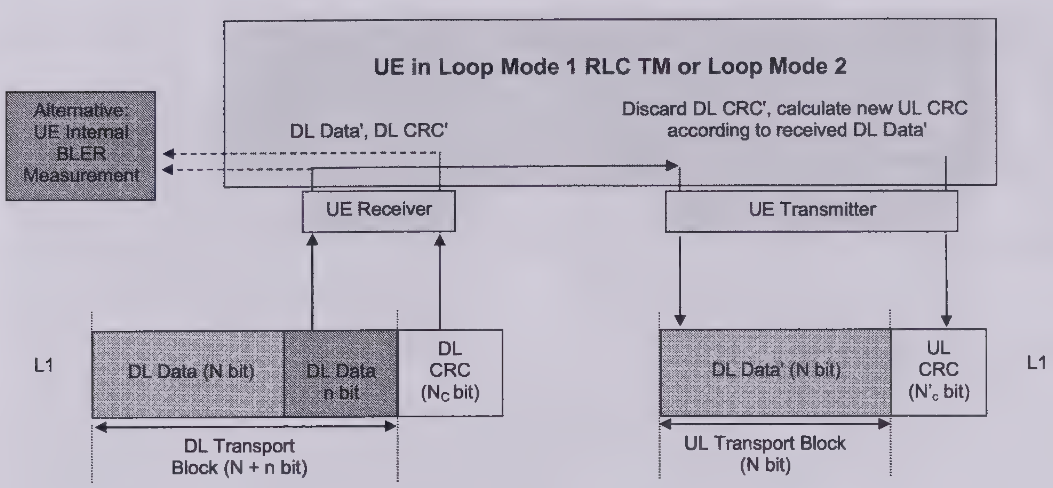

UE in Loop Mode 1 RLC TM or Loop Mode 2
Alternative: UE Internal BLER Measurement
DL Data', DL CRC'
Discard DL CRC', calculate new UL CRC according to received DL Data'
UE Receiver
UE Transmitter
L1
DL Data (N bit)
DL Data n bit
DL CRC (N_C bit)
DL Transport Block (N + n bit)
DL Data' (N bit)
UL CRC (N'_c bit)
UL Transport Block (N bit)
L1

Fig. 4-44 BER and DBLER measurement with asymmetric RMCs

Preconditions Asymmetric *Receiver Quality* tests are provided in *Signalling* mode only. They are configured in the *RMC Settings* section of the *BS Signal* tab of the *Connection Control* menu.

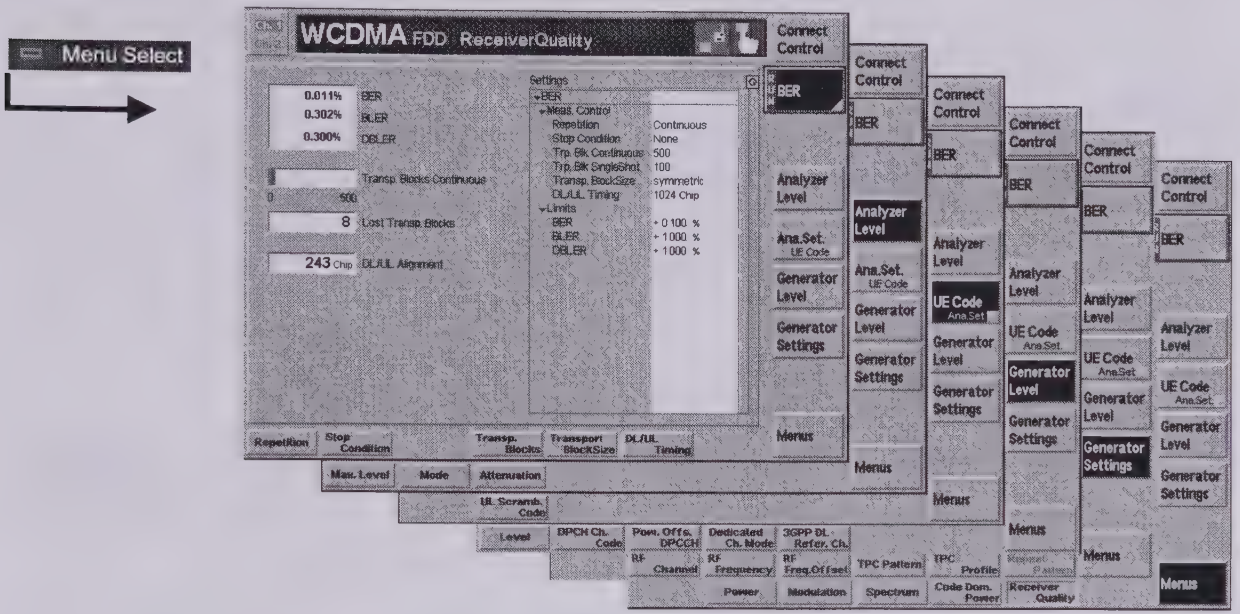
To perform an asymmetric *Receiver Quality* test, the UE must be set to either *Loop Mode 1 RLC TM* or *Loop Mode 2.* The uplink CRC is always enabled; the *Uplink CRC* function is grayed. A *Reference Channel Type* with different data rates in the DL and UL must be selected.

Main Menu (Receiver Quality)

The main menu *Receiver Quality* shows the results and the most important parameters of the *Receiver Quality* measurement.

- The measurement control softkey *BER* (which changes to *UE Report* if this application is selected) controls the *Receiver Quality* measurement, indicates its status *(RUN, HLT, OFF)* and opens the configuration menu *Receiver Quality Configuration*. The hotkeys associated to the measurement control softkey define the scope of the measurement.
- The softkeys *Application, Analyzer Level, Analyzer Settings/UE Code, Generator Level, Generator Settings* and *Menus* on the right softkey bar are combined with various hotkeys. When a softkey is selected and an associated hotkey pressed, a popup window appears which indicates a setting or enables an entry.
- In the tables in the center of the menu, the test settings of the current *Receiver Quality* measurement and the results are displayed.

The measurement menu *Receiver Quality* is opened from the main menu *Menu Select* (with the associated key at the front of the instrument) or from the menu group *WCDMA UE TX Test (3GPP/FDD)* using the hotkey *Receiver Quality*.


Menu Select
WCDMA FDD ReceiverQuality
Connect Control
BER
Analyzer Level
Ana.Set. UE Code
Generator Level
Generator Settings
Menus
Repetition
Stop Condition
Transp. Blocks
Transport BlockSize
DL/UL Timing
Max. Level
Mode
Attenuation
UL Scramb. Code
Level
DPCH Ch. Code
Pow. Offs. DPCCH
Dedicated Ch. Mode
3GPP DL Refer. Ch.
RF Channel
RF Frequency
RF Freq.Offset
TPC Pattern
TPC Profile
Power
Modulation
Spectrum
Code Dom. Power
Receiver Quality

0.011% BER
0.302% BLER
0.300% DBLER
Transp. Blocks Continuous 0 500
8 Lost Transp. Blocks
243 Chip DL/UL Alignment

Settings
BER
Meas. Control
Repetition: Continuous
Stop Condition: None
Trp. Blk Continuous: 500
Trp. Blk SingleShot: 100
Transp. BlockSize: symmetric
DL/UL Timing: 1024 Chip
Limits
BER: + 0.100 %
BLER: + 10.00 %
DBLER: + 10.00 %

Fig. 4-45 Main menu Receiver Quality (BER, Non Signalling)

Test Settings

The settings associated to the *Analyzer Level, Analyzer Settings, Generator Level,* and *Generator Settings* softkeys and the function of the *Menus* softkey are identical with the *Power* menu (see section *Test Settings* on page 4.6 ff.). The following softkey/hotkey combinations differ from the *Power* measurement:

BER

The *BER* softkey controls the receiver quality measurement in the BER application and indicates its status *(RUN | HLT | OFF* for BER, *RUN | OFF* for UE Report). In *Signalling* mode, this softkey changes to *UE Report,* depending on the measurement application selected; see *Application* softkey below.

This status can be changed after softkey selection (pressing once) by means of the *ON/OFF* key or the *CONT/HALT* key. The status of the measurement is unaffected upon switchover to other menus controlling a *Receiver Quality* measurement; however, a running measurement is restarted.

Remote control
```
INITiate:RXQuality:<Applic>
ABORt:RXQuality:<Applic>
STOP:RXQuality:<Applic>
CONTinue:RXQuality:<Applic>
FETCh:RXQuality:<Applic>:STATus?
```

Measurement configuration

Pressing the *BER* softkey twice opens the popup menu *Receiver Quality Configuration.* Besides, hotkeys defining the scope of the measurement are associated to the *BER* softkey. These hotkeys are also provided in the configuration menu; see section *Measurement Configurations (Receiver Quality Configuration)* on page 4.101 ff.

Application

The *Application* softkey selects the *Receiver Quality* application. This softkey is not available in *Non Signalling* mode where only a single application *BER* is available.

The alternative measurements (applications) are displayed in different measurement menus. When an application is selected, the corresponding measurement menu is called up. The configuration settings for all applications, however, are listed in a common popup menu (see p. 4.101 ff.).

BER

BER selects the measurement of the receiver quality parameters (BER, BLER, DBLER) by the CMU.

Remote control
The *BER* application is selected by the keyword `:BER` in the 3rd level of the `RXQuality` commands, e.g. `CONFigure:RXQuality:BER...`

UE Report

The *UE Report* hotkey selects the display of information elements provided by the UE and transferred in the UE measurement report message.

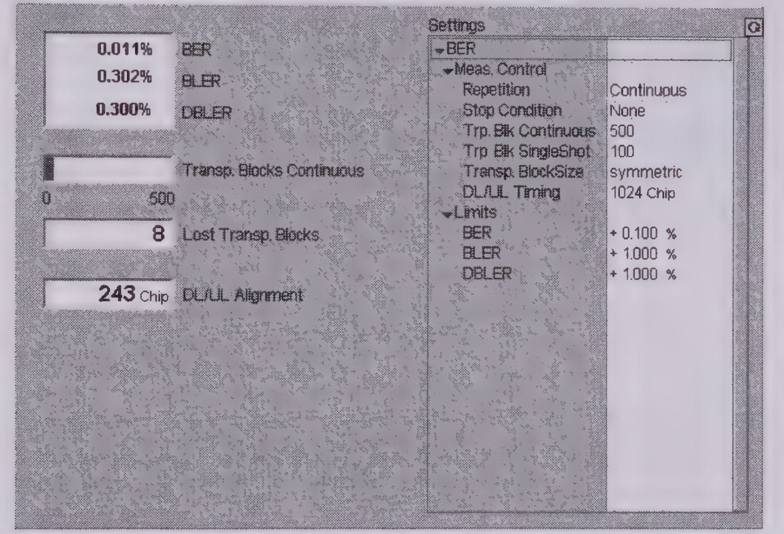
Remote control
The *UE Report* application is selected by the keyword `:UEReport` in the 3rd level of the `RXQuality` commands, e.g. `CONFigure:RXQuality:UEReport...`

Measurement Results

In *Signalling* mode, the *Receiver Quality* menu group contains two separate measurement menus corresponding to the applications *BER* and *UE Report*. The *UE Report* menu is not available in *Non Signalling* mode.

BER

The test settings of the current *BER* measurement and the results are displayed in the tables in the center of the menu.



0.011% BER
0.302% BLER
0.300% DBLER
Transp. Blocks Continuous
8 Lost Transp. Blocks
243 Chip DL/UL Alignment

Settings

BER	
Meas. Control	
Repetition	Continuous
Stop Condition	None
Trp. Blk Continuous	500
Trp Blk SingleShot	100
Transp. BlockSize	symmetric
DL/UL Timing	1024 Chip
Limits	
BER	+ 0.100 %
BLER	+ 1.000 %
DBLER	+ 1.000 %

Fig. 4-46 Display of test settings and measurement results (BER)

Results The output in the left half of the menu shows the results of the *Receiver Quality* measurement:

BER	Bit Error Rate, ratio of data bit errors to total number of transferred data bits.
BLER	Block Error Rate, ratio of blocks received with wrong data or CRC bits to total number of received blocks. This result is available with asymmetric *Transport Block Size* only.
DBLER	Data Block Error Rate, ratio of blocks received with wrong data bits to total number of received blocks.

The three quantities are explained in more detail in section *Receiver Quality Measurements* on p. 4.91 ff.

A bar below the table indicates the relative measurement progress, i.e. the ratio between the current measurement time and the total measurement time. The total number of transport blocks per measurement cycle *(Measurement Length)* is indicated below the bar.

Below the progress bar two additional measurement results are indicated:

Lost Transp. Bl.	Difference between the number of blocks sent and the number of blocks received from the UE under test. Lost blocks do not enter into the calculation of the BLER and DBLER, so the number of lost transport blocks is an additional indicator for the quality of the whole connection from the CMU to the UE and back.
DL/UL Alignment	Measured time offset (in integer chip periods) between the UL signal transmitted by the UE relative to the received DL signal from the CMU. The nominal DL/UL timing amounts to 1024 chips. To facilitate synchronization of the CMU to the UL signal, a correction to the nominal DL/UL timing can be defined; see *DL/UL Timing* parameter in section *Measurement Control (Receiver Quality Configuration – Control)* on p. 4.101 ff.

Limit Check

A red output field indicates that the measurement result exceeds the upper limit set in the *Limits* tab of the *Receiver Quality* configuration menu; see p. 4.103 ff.

Remote Control

```
READ[:SCALar]:RXQuality:BER?
FETCh[:SCALar]:RXQuality:BER?
SAMPle[:SCALar]:RXQuality:BER?
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?
```

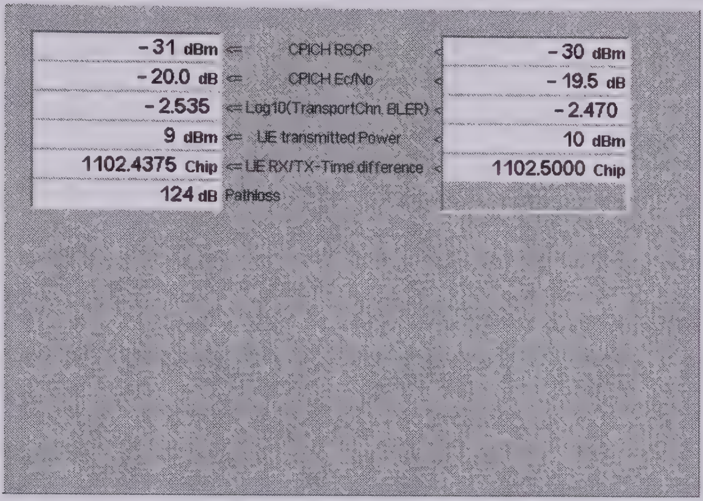
Settings

The *Settings* table gives an overview of the configuration of the current measurement. This includes the settings made via the softkeys and hotkeys of the *Receiver Quality* menu or in the *Control* tab of the configuration menu, and the tolerances set in the *Limits* tab of the *Receiver Quality Configuration* menu, see section *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on page 4.103.

The parameters depend on the current application and the measurement mode.
Remote control
See sections *Test Settings* on page 4.96 and *Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)* on p. 4.103.

UE Report (Signalling only)

The *UE Report* values are displayed in two tables.



-31 dBm	<= CPICH RSCP <	-30 dBm
-20.0 dB	<= CPICH Ec/No <	-19.5 dB
-2.535	<= Log10(TransportChn. BLER) <	-2.470
9 dBm	<= UE transmitted Power <	10 dBm
1102.4375 Chip	<= UE RX/TX-Time difference <	1102.5000 Chip
124 dB	Pathloss	

Fig. 4-47 Display of test settings and measurement results (UE Report)

Results

The tables show a value or an interval for each of the following information elements provided by the UE and transferred in the measurement report message:

CPICH RSCP	Integer 1-dB interval for the Received Signal Code Power of the CPICH. For CPICH RSCPs below –115 dBm (above –25 dBm), no lower (upper) limit is indicated.
CPICH E_c/I_0	0.5-dB interval for the ratio of the received energy per PN chip for the CPICH to the total received power spectral density at the UE antenna connector. For E_c/I_0 below –24 dB (above 0 dB), no lower (upper) limit is indicated.
Log 10(Transport channel BLER)	Estimate of the transport channel (TCH) block error rate (BLER). 64 intervals for the logarithm of the TCH BLER are available. The maximum logarithmic TCH BLER is 0, corresponding to a BLER of 1. For values below –4.03 the lower limit is –∞, corresponding to a BLER of 0.
UE transmitted power	Integer 1-dB interval for the total UE transmitted power on one carrier measured at the antenna connector of the UE. The power must be in the range between –50 dBm and above +34 dBm.
UE RX/TX time difference	Interval for the difference in time between the UE uplink DPCCH/DPDCH frame transmission and the first detected path (in time) of the downlink DPCH frame from the measured radio link. The time difference is expressed in multiples of a chip period. For time differences below 768 chips (above 1280 chips), no lower (upper) limit is indicated.
Pathloss	Downlink pathloss in dB = *Reported P-CPICH Power - CPICH RSCP*. Values below +46 dB (above +158 dB) are reported as +46 dB (+158 dB). The reported P-CPICH power corresponds to the value set in the *UE Signal* tab of the *Connection Control* menu; the *CPICH RSCP* is measured by the UE. To simulate real propagation conditions the reported P-CPICH power is much larger than the actual power of the BS signal, so the order of magnitude of the reported pathloss is 80 dB.

The measurement report message is described in standard 3GPP TS 34.123; the information elements in standard 3GPP TS 25.215. The information elements in the message are optional and can be switched off separately in the *Control* tab of the *Receiver Quality Configuration* menu (see p. 4.101 ff.) in case that the UE under test does not provide a particular result.
To display the results, the measurement control softkey *UE Report* must be switched on.

Remote Control
`[SENSE]:RXQuality:UEReport<nr>?`

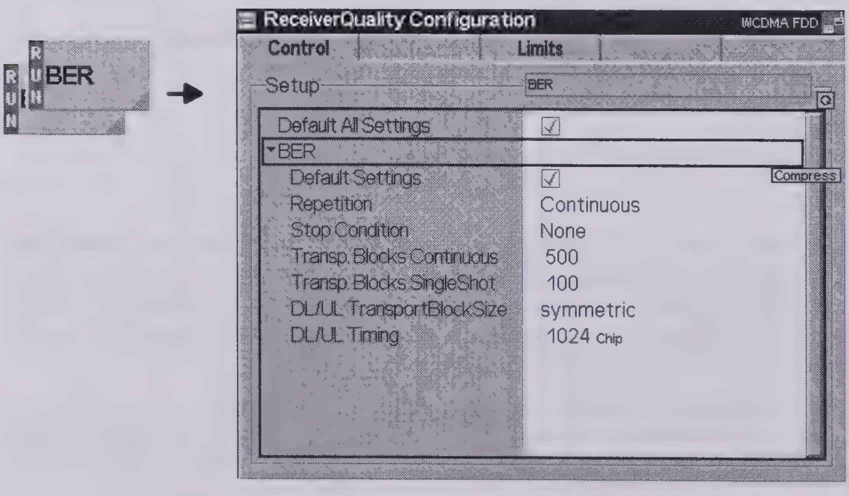
Measurement Configurations (Receiver Quality Configuration)

The popup menu *Receiver Quality Configuration* contains two tabs to define the parameters for the bit error rate measurement. It is opened by pressing the measurement control softkey *BER* at the top right in the main menu *Receiver Quality* twice. It is possible to change between the tabs by pressing the associated hotkeys.

Measurement Control (Receiver Quality Configuration – Control)

The *Control* tab controls the *Receiver Quality* measurement by determining

- The *Repetition* mode
- The *Stop Condition* for the measurement
- The number of transport blocks per measurement cycle *(Transp. Blocks,* in *Non Signalling* mode only)
- The relative size of UL and DL transport blocks *(DL/UL Transport Block Size,* in *Non Signalling* mode only)
- The UE report information elements to be displayed *(UE Report,* in *Signalling* mode only)



Default All Settings ☑
BER
Default Settings ☑
Repetition Continuous
Stop Condition None
Transp. Blocks Continuous 500
Transp. Blocks SingleShot 100
DL/UL TransportBlockSize symmetric
DL/UL Timing 1024 Chip

Fig. 4-48 Receiver Quality – Control (Non Signalling)

The *Repetition* mode and *Stop Condition* comply with the corresponding settings in the *Control* tab of the *Power Configuration* menu (see page 4.18). In the remote-control commands, the keywords `POWer:<Pow_Application>` are to be replaced by `RXQuality:BER`. The following parameters are specific to the *Receiver Quality* measurement:

Default

The *Default* switches overwrite all settings in the *Control* tab with default values. The default values are quoted in the command description in chapter 6 of this manual.

Remote control
`DEFault:RXQuality:CONTrol  ON | OFF`

Transport Blocks

The *Transport Blocks* parameter defines the number of transport blocks to be sent per measurement cycle. Different numbers can be defined for single shot *BER* measurements (only one measurement cycle) and continuous measurements (measurement cycle repeated periodically).

Remote control
`CONFigure:RXQuality:BER:CONTrol:TBLocks <Blocks>`

DL/UL Transport Block Size

The *DL/UL Transport Block Size* parameter defines whether DL and UL transport block sizes are different *(asymmetric)* or the same *(symmetric)*. An asymmetric block size is required to obtain the Block Error Rate (BLER). The Bit Error Rate (BER) and Data Block Error Rate (DBLER) can be measured irrespective of the *Transport Block Size;* see section *Test Loops for BER, BLER and DBLER Tests* on p. 4.93 ff.

Note: *In Signalling mode the Uplink CRC parameter in the BS Signal tab replaces the DL/UL Transport Block Size.*

Remote control
`CONFigure:RXQuality:BER:CONTrol:TBSize <Symmetry>`

DL/UL Timing

The *DL/UL Timing* parameter sets the delay time (in integer chip periods) of the UL signal transmitted by the UE relative to the received DL signal from the CMU. The default value corresponds to the nominal DL/UL timing offset of 1024 chips. A different value can be necessary to compensate for a path delay or a deviation of the UE from the nominal timing.

If the actual DL/UL timing offset differs too much from the *DL/UL Timing,* the CMU is unable to synchronize to the UL signal and generates the warning message *RX not synchronized*. The measured *UL/DL Alignment* is indicated in the *Receiver Quality* menu; see section *Measurement Results* on p. 4.98 ff.

Note: *In Signalling mode the DL/UL Timing is not needed. The UE synchronizes to the BS signal in order to set up a connection.*

Remote control
`CONFigure:RXQuality:BER:CONTrol:TIMing <Chips>`

UE Report

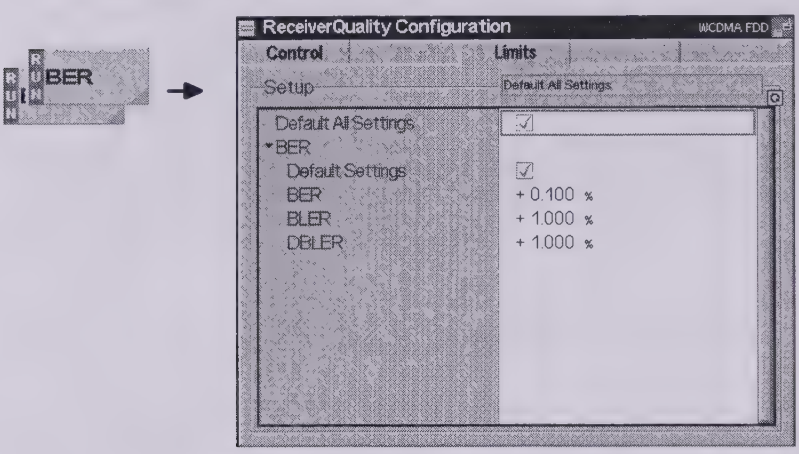
The toggle switches in the *UE Report* section enable or disable the evaluation and display of the optional individual information elements included in the UE measurement report message. The purpose of this section is to adjust the CMU display to the UE capabilities. For a definition of the information elements refer to section *UE Report (Signalling only)* on p. 4.99 ff.

In the default configuration *(Default Settings* on) all information elements are displayed. As an alternative to switching off all elements, use the measurement control softkey to switch off the entire UE Report.

Remote control
```
DEFault:RXQuality:UEReport:ENABle
CONFigure:RXQuality:UEReport<nr>:ENABle (<nr> = 1 to 6)
```

Upper Limits for Bit Error Rate (Receiver Quality Configuration – Limits)

The *Limits* tab defines the upper limits for the individual measured quantities in the *Receiver Quality* menu. The standard TS 34.121 specifies a maximum BER of 0.1% and a maximum BLER of 1% for most test cases. The DBLER is closely related to the BLER; see *Fig. 4-41 on p.* 4.93.



Default All Settings

Default All Settings	☑
▾BER	
Default Settings	☑
BER	+ 0.100 %
BLER	+ 1.000 %
DBLER	+ 1.000 %

Fig. 4-49 Receiver Quality Configuration – Limits

Default Settings The *Default* switches overwrite all settings in the *Control* tab with default values. The default values are quoted in the command description in chapter 6 of this manual.

Remote control
`DEFault:RXQuality:LIMit <Enable>`

BER The *BER* section defines upper limits for the three different bit error rates obtained in the *Receiver Quality* measurement. All limits are in the value range 0% to 100%.

BER	Upper limit for the Bit Error Rate
BLER	Upper limit for the Block Error Rate
DBLER	Upper limit for the Data Block Error Rate

Remote control
```
CONFigure:RXQuality:BER:CURRent:LIMit[:SCALar]:ASYMmetric
   :UPPer:VALue  <Limit_BER>, <Limit_BLER>, <Limit_DBLER>
```

Audio Measurements

The menu group *Audio* comprises the functions for generating and measuring single or multitone audio signals. The menu group is available with option CMU-B41, *Audio Generator and Analyzer*. All *Audio* menus and remote-control commands are described in the CMU 200/300 operating manual.

The *Audio* option supports two independent test circuits. In *Non Signalling* mode the input and output connectors for both circuits are fixed; they are indicated in the *AF/RF* ↔ tab of the *Connection Control* menu; see section *AF/RF Connectors (Connection Control – AF/RF)* on p. **6.132** ff. This test mode corresponds to the standalone Audio tests described in the CMU 200/300 operating manual.

In Signalling mode, it is possible to send and receive audio data modulated onto the RF carrier and thus test the audio circuit of a connected mobile phone (see section *AF/RF Connectors (Connection Control – AF/RF)* on p. 6.180 ff.).

Connection Control (Non Signalling)

The popup menu *Connection Control* contains several tabs to configure the inputs and outputs of the CMU and the respective signals in the function group *WCDMA UE TX Test* (3GPP/FDD). The functions of the *WCDMA (3GPP/FDD, DL) Generator* (option R&S CMU-K66) are integrated in the *Connection Control* menu; see section *Generator Settings (Connection Control – Generator)* on p. 4.109 ff.

The menu group is activated via the softkey *Connect. Control* to the right of the header of each measurement menu. The individual popup menus *(Analyzer, Generator (with option R&S CMU-K66 only), UE Code, AF/RF* ⊕ and *Sync.)* can be accessed via the hotkeys at the lower edge of the screen.

The settings in the *Connection Control* menu are general settings that are valid for the entire *Non Signalling* function group. Changing general settings in any application will have an impact on all measurements and applications of the function group.

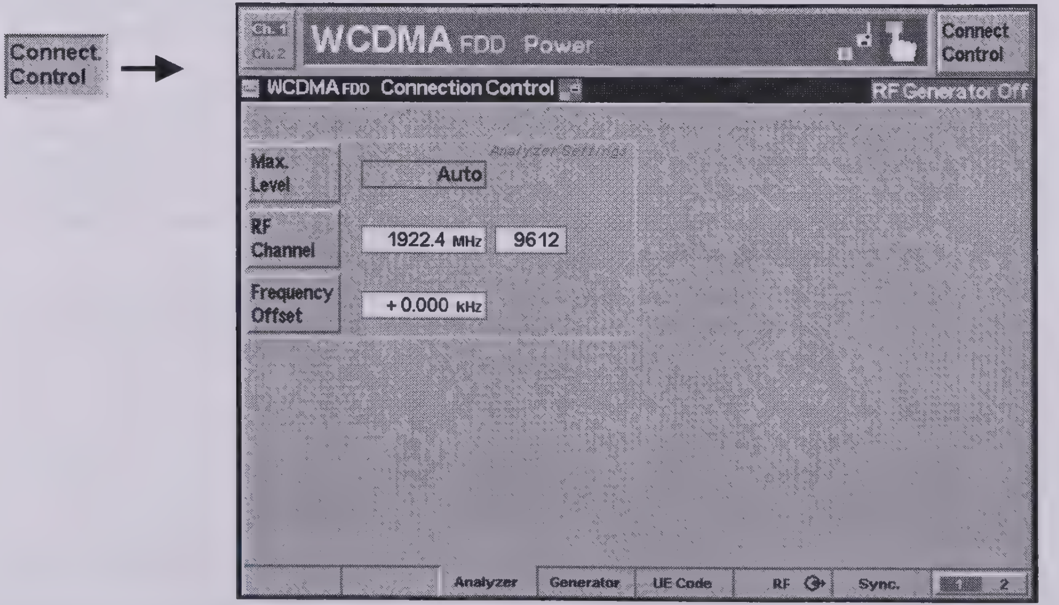
Analyzer Settings (Connection Control – Analyzer)

The *Analyzer* tab of the *Connection Control* menu controls the level in the RF input signal path and defines the frequency of the RF signal analyzed as well as the trigger settings. The CMU provides a panel oriented version of the *Analyzer* tab and a table oriented version with extended functionality. The *Analyzer* hotkey toggles between the two versions if it is pressed repeatedly.

Panel Oriented Version

The panel oriented version of the *Analyzer* tab controls:

- The maximum expected input level (Max. Level)
- The RF channel (RF Channel) and corresponding nominal channel frequency
- The Frequency Offset of the signal analyzed by the CMU (Analyzer Settings)



Max. Level: Auto

RF Channel: 1922.4 MHz 9612

Frequency Offset: + 0.000 kHz

Fig. 4-50 Connection Control – Analyzer (panel)

Max. Level

The *Max. Level* softkey sets the maximum expected input level (overload level). This level corresponds to the maximum peak envelope power (PEP) of the WCDMA signal that the CMU is able to measure. Input levels exceeding the *Max. Level* overdrive the input path and cause invalid results ("– – –").

In the table oriented version of the *Analyzer* tab, either manual or automatic setting of the input level can be selected. The behavior of the *Max. Level* softkey depends on the way the input level is set:

- In manual mode, the input level is indicated in the input field to the right of the softkey. This field can be activated and the level can be changed by pressing the *Max. Level* softkey. Note the remarks on *external input attenuation* on p. 4.108.
- If autoranging is selected, *Auto* is indicated in the input field to the right of the softkey. *Max. Level* is not active. To change the input level and mode, the table oriented *Analyzer* tab must be opened by pressing the *Analyzer* hotkey again.

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

RF Channel

The *RF Channel* softkey defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the measured signal. The assignment between channel numbers *N* and carrier frequencies *F* is defined in the 3GPP specification (TS 34.121). The following relation holds for both directions of transmission (uplink and downlink) and all operating bands (I, II and III):

$$N = 5 \cdot (F / MHz), \quad 0.0\ MHz \le F \le 3276.6\ MHz$$

The CMU accepts the entry of frequency **or** channel number, provided that the assignment is unambiguous, i.e. that the channel number is assigned in one of the three operating bands and that it is calculated according to the formula quoted above. If the channel number is not assigned, the channel input field shows an invalid channel result "—".

In operating band II, 12 additional center frequencies are specified, which are shifted by 100 kHz relative to the normal raster, see *Table 4-6 below*. These channels must be selected with their channel numbers; it is not possible to enter frequencies off the 200 kHz raster.

It is possible, however, to enter arbitrary UARFCNs or RF frequencies outside the uplink bands, provided that the frequencies are in multiples of 200 kHz and within the specified range of the RF analyzer (see data sheet). Moreover, the analyzer frequency can be modified by an additional *Frequency Offset* entered by means of the softkey below so that any frequency within the specified range can be defined as a center frequency of the analyzer.

Note: *The 100/200 kHz frequency raster of the UARFCN frequencies must not be confused with the much wider WCDMA carrier spacing of 5 MHz.*

Remote control
`UNIT:RFANalyzer:FREQuency <Unit>`
`[SENSe:]RFANalyzer:FREQuency <Frequency>`

Table 4-6 UTRA operating bands and channel numbers: Uplink

Operating Band	UL Frequency Band	Assigned Channels	Assigned Center Frequencies
I	1920 MHz to 1980 MHz	9612 to 9888	1922.4 MHz to 1977.6 MHz
II	1850 MHz to 1910 MHz	9262 to 9538, 12, 37, 62, 87, 112, 137, 162, 187, 212, 237, 262, 287	1852.4 MHz to 1907.6 MHz, 1852.5, 1857.5, 1862.5, 1867.5, 1872.5, 1877.5, 1882.5, 1887.5, 1892.5, 1897.5, 1902.5, 1907.5
III	1710 MHz to 1785 MHz	8562 to 8913	1712.4 MHz to 1782.6 MHz

Frequency Offset

The *Frequency Offset* softkey defines an offset for the frequency set under RF Channel. This enables fine tuning of the frequency measured by the CMU, e.g. in order to simulate a Doppler shift (caused by a relative movement between UE and Node B) or detuning of the UE.

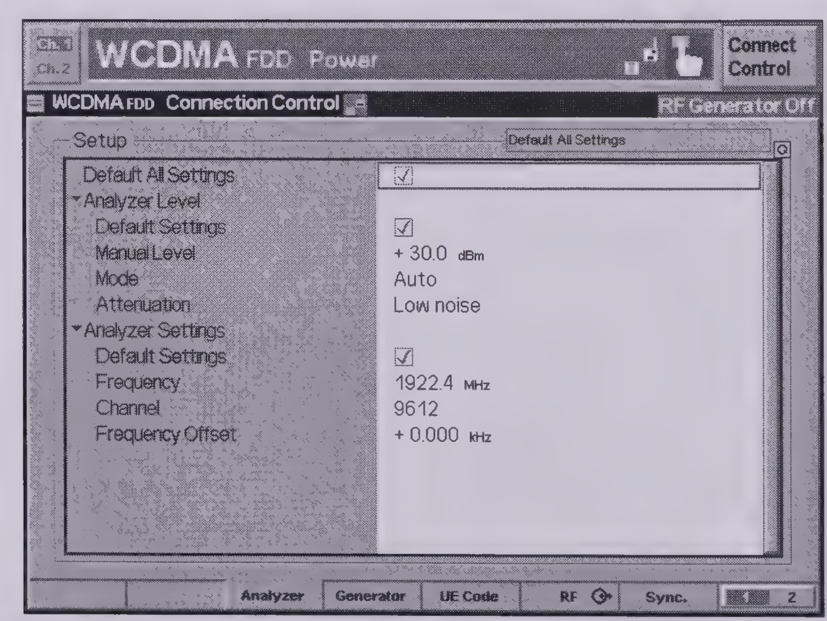
Remote control
`[SENSe:]RFANalyzer:FOFFset <Offset>`

Table Oriented Version

The table oriented version of the *Analyzer* tab controls:

- The maximum expected input level *(Max. Level)* and the way it is defined *(Mode)*
- An external input attenuation or gain *(Attenuation)*
- The analyzer frequency *(Analyzer Settings)*

Connect Control →


Ch.1
Ch.2
WCDMA FDD Power
Connect Control
WCDMA FDD Connection Control
RF Generator Off
Setup
Default All Settings
Analyzer
Generator
UE Code
RF
Sync.
1
2

- Default All Settings ☑
- Analyzer Level
  - Default Settings ☑
  - Manual Level +30.0 dBm
  - Mode Auto
  - Attenuation Low noise
- Analyzer Settings
  - Default Settings ☑
  - Frequency 1922.4 MHz
  - Channel 9612
  - Frequency Offset +0.000 kHz

Fig. 4-51 Connection Control – Analyzer (table)

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Analyzer* tab (the default values are quoted in the command description in chapter 6 of this manual).

Remote control
`DEFault:LEVel ON | OFF`

Analyzer Level – Mode

The *Analyzer Level* table section sets the maximum input level that can be measured. Two alternative *Modes* for defining this value are provided:

Manual	Manual input of maximum input level in the *Manual Level* field
Auto	Automatic setting of maximum input level *(autoranging)* according to the peak power (PEP) of applied signal

Remote control
`[SENSe:]LEVel:MODE <Mode>`

Analyzer Level – Manual Level

The maximum input level can be entered in the *Manual Level* input field.

Remote control
`[SENSe:]LEVel:MAXimum <Level>`

External input attenuation

The range of *Max. Level* values depends on the RF input used. If an external input attenuation is reported to the instrument to compensate for a known path loss (see section *RF Connectors (Connection Control – RF Connectors)* on page 4.107), all levels measured are referenced to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.

Error messages

If the value determined for *Max. Level* is too high or too low, a window with the error message *"<Max_Level> is out of range. <permissible max. value> is limit."* and three fields will appear:

Accept	The permissible max. value is accepted as Max. Level,
Re-edit	Max. Level is entered once again,
Cancel	The last valid input value is maintained.

When switching over to another input, the current value of *Max. Level* is automatically adapted, if required:

- Towards lower values to the maximum value of the new input,
- Towards upper values to the minimum value of the new input.

Note: *A maximum input level can be entered even if automatic level setting (autoranging) is selected. The entered level is used as a start value for the autoranging routine and is also important to ensure safe switchover to manual setting.*

Analyzer Level – Attenuation

The *Attenuation* field defines how the RF analyzer of the CMU is tuned to meet the requirements of the current measurement type. In general, a compromise between the acceptable noise level in the displayed result and the contribution of internally generated distortion must be reached.

Normal	Mixer level in normal range,
Low noise	Mixer level enhanced by +10 dB (full dynamic range of CMU, therefore recommended for *Power* and *Spectrum* measure-

ments),

Low distortion Mixer level reduced by –10 dB (high intermodulation spacing, therefore recommended for *Modulation* measurements).

The *Attenuation* setting permits the CMU to be adapted to the requirements of the measurement. The advantages and disadvantages of the settings *Low noise* and *Low distortion* are listed in the following table.

	Advantages	Disadvantages
Low noise	Low noise high dynamic range	No RF overdrive reserve Risk of intermodulation
Low distortion	High intermodulation spacing	Lower dynamic range

Remote control
`[SENSe:]LEVel:ATTenuation NORMal | LNOise | LDIStortion`

Analyzer Settings The *Analyzer Settings* table section defines the RF analyzer frequency. All settings are also provided in the softkey-oriented version of the *Analyzer* tab; see section *Panel Oriented Version* on p. 4.105 ff.

Remote control
`[SENSe:]RFANalyzer:FREQuency <Frequency>`
`[SENSe:]RFANalyzer:FOFFset <Offset>`

Generator Settings (Connection Control – Generator)

The *Generator* tab of the *Connection Control* menu controls the CMU's RF generator and configures the generated RF signal. It is available with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only. The CMU provides a panel oriented version of the *Generator* tab and a table oriented version with extended functionality. The *Generator* hotkey toggles between the two versions if it is pressed repeatedly.

RF Generator The RF generator provides a WCDMA downlink signal at arbitrary carrier frequency and variable level. The signal includes the following physical channels:

- Downlink Dedicated Physical Channel (DPDCH, DPCCH)
- Primary Common Pilot Channel (P-CPICH)
- Primary and Secondary Synchronization Channel (P-SCH, S-SCH)
- Primary Common Control Physical Channel (CCPCH)
- Page Indicator Channel (PICH)

The total signal level and the relative levels of the individual physical channel contributions can be varied over a wide range. The dedicated channels can be configured in two alternative ways:

- The *3GPP DL Reference Channel* is defined on transport channel level. The data sequence to be transferred is directly fed into the DTCH and DCCH. The transport channels are channel coded, multiplexed and mapped onto a dedicated physical channel (DPCH) with variable data rate. The downlink reference measurement channel generated in this way is to be used for various transmitter and receiver tests specified in standard 3GPP TS 25.101.
- The *DL Physical Channel* is defined in terms of its slot format. The data sequence to be transferred is fed into the data fields of the DPDCH without channel coding. The DPDCH is time-multiplexed with the DPCCH according to standard 3GPP TS 25.211.

All settings are explained in detail in the following subsections.

Application

The purpose of the generator is to provide a WCDMA signal which can be used to synchronize the UE and to transfer data from the tester to the UE. The RF generator signal represents a flexible WCDMA downlink test signal and a valuable tool for performing TX and RX measurements, such as

- Inner loop Transmit Power Control (TPC); see section *Test Scenarios for Inner Loop TPC* on p. *4.3 ff.* To control the *Inner Loop TPC* measurement a set of *TPC Settings* is provided at the generator; see p. 4.124.
- Bit Error Rate (BER) tests with known data sequence transmitted on the downlink channel and UE-assisted evaluation or calculation of the BER, BLER and DBLER by the tester; see section *Receiver Quality Measurements* on p. *4.91* ff.
- The RF generator is also used in *Signalling* test mode where it provides the *Node B* signal (see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.167 ff.), which is necessary to set up a connection and make measurements.

Synchronization of the UE and data transfer is described in section *Downlink Channels and Synchronization* on p. 4.110 ff.

The WCDMA uplink and downlink signals differ in their channel structure and in the way the physical channels are built. *Table 4-7 below* summarizes the parameters that are relevant for this section.

Table 4-7 WCDMA specifications

Parameter	**Uplink**	**Downlink**
Chip rate	3.84 Mcps	3.84 Mcps
Frame structure	10 ms radio frame divided into 15 slots (2560 chips/slot)	10 ms radio frame divided into 15 slots (2560 chips/slot)
Spreading codes	Orthogonal Variable Spreading Factor (OVSF) channelization codes and long and short scrambling codes (Gold sequences) for user separation	Orthogonal Variable Spreading Factor (OVSF) channelization codes for channel separation, Gold sequences of length $2^{18} - 1$ for cell and user separation
Spreading factors / symbol rates	4, 8, 16, ..., 256 960 ksps, ..., 15 ksps	4, 8, 16, ..., 512 960 ksps, ..., 7.5 ksps
Channel multiplexing	Control and pilot channel time-multiplexed, I/Q multiplexing for data and control channels	Data and control channels time-multiplexed

Downlink Channels and Synchronization

The RF generator provides a set of five downlink physical channels sufficient for synchronization of the UE and data transfer. In addition, it generates the PICH which is to be used in many of the conformance tests described in standard TS 34.121. Other channels that are exclusively intended to carry signalling information are not included in the generator signal.

Downlink physical channels

The radio resources in a WCDMA system are divided into physical channels characterized by a specific carrier frequency, scrambling and channelization code, and duration. The time duration is conveniently defined in integer multiples of chips, slots and radio frames. With a chip rate of 3.84 Mcps, a slot corresponds to 2560 chips. A frame consists of 15 slots, i.e. 38400 chips or 10 ms.

The standard specifies different physical channel types. The channels are generated by mapping transport channel information into a physical channel and differ in their physical parameters. Common channels carry messages that are not directed at a particular UE; they are point-to-multipoint channels. Dedicated channels carry information related to a particular connection; they are point-to-point bidirectional channels. An overview of the physical channels of the CMU DL generator signal is given in Table 4-8 *below*.

Table 4-8 Downlink physical channels in the CMU generator signal

Channel type	**Purpose**	**Properties**
Primary Common Pilot Channel P-CPICH	Determination of the scrambling code out of a scrambling code group (2^{nd} stage of scrambling code detection, see below) Phase reference for SCH and other downlink physical channels Reference for the generator signal strength	Fixed rate (30 kbps, SF = 256) Fixed spreading code $c_{256,\,0}$ Primary scrambling code Predefined symbol sequence
Primary Synchronization Channel P-SCH	Slot synchronization between CMU and UE (1^{st} synchronization step, see below)	Fixed 256-chip code (primary synchronization code) Time-multiplexed with P-CCPCH No channelization, no scrambling
Secondary Synchronization Channel S-SCH	Frame synchronization between CMU and UE (2^{nd} synchronization step, see below) Provides the scrambling code group (1^{st} stage of scrambling code detection, see below)	256-chip code depending on the slot no. and the scrambling code group (secondary synchronization code) Time-multiplexed with P-CCPCH No channelization, no scrambling
Primary Common Control Physical Channel P-CCPCH	Transmits the System Frame Number (SFN) and is used as a timing reference for all physical channels Carries the BCH transport channel (filled with an All 0 sequence by the CMU generator)	Fixed rate (30 kbps, SF = 256) Fixed spreading code $c_{256,\,1}$ Primary scrambling code Time-multiplexed with SCH
Dedicated Physical Channel DPCH	Transfer of control information and user data to the UE	Spreading factors from 512 down to 4 Primary or secondary scrambling code DPDCH and DPCCH time-multiplexed
Page Indicator Channel PICH	Transfer of paging indicators to the UE. Required to be present in many conformance tests.	Fixed rate (SF = 256) physical channel. Primary scrambling code Channelization codes can be set between 2 and 255. All PICH bits fixed to –1.

The CMU uses the scheme defined in TS 25.213 to spread and combine the five channels (see *Fig. 4-52 below*). The real-valued P-CPICH, P-CCPCH, DPCH and PICH symbols are first mapped to an I and Q branch. The I and Q branches of each channel are spread to the chip rate using the same channelization code $C_{SF,m}$. The channelization codes of the P-CPICH and P-CCPCH are fixed. The spreading factor (SF) for the DPCH is given by its slot format number (see *Table 4-14* on p. 4.124) and the selectable *DPCH Channelization Code* m. The complex-valued chip sequences are scrambled with primary or secondary scrambling codes S^p or S^s; see paragraph on *Downlink scrambling codes* on p. 4.118, weighted with individual factors G and then combined using complex addition. The G factors are directly related to the individual channel levels set at the CMU.

The complex-valued synchronization channels P-SCH and S-SCH are not spread but weighted separately and then added to the combined P-CPICH, P-CCPCH, DPCH and PICH.

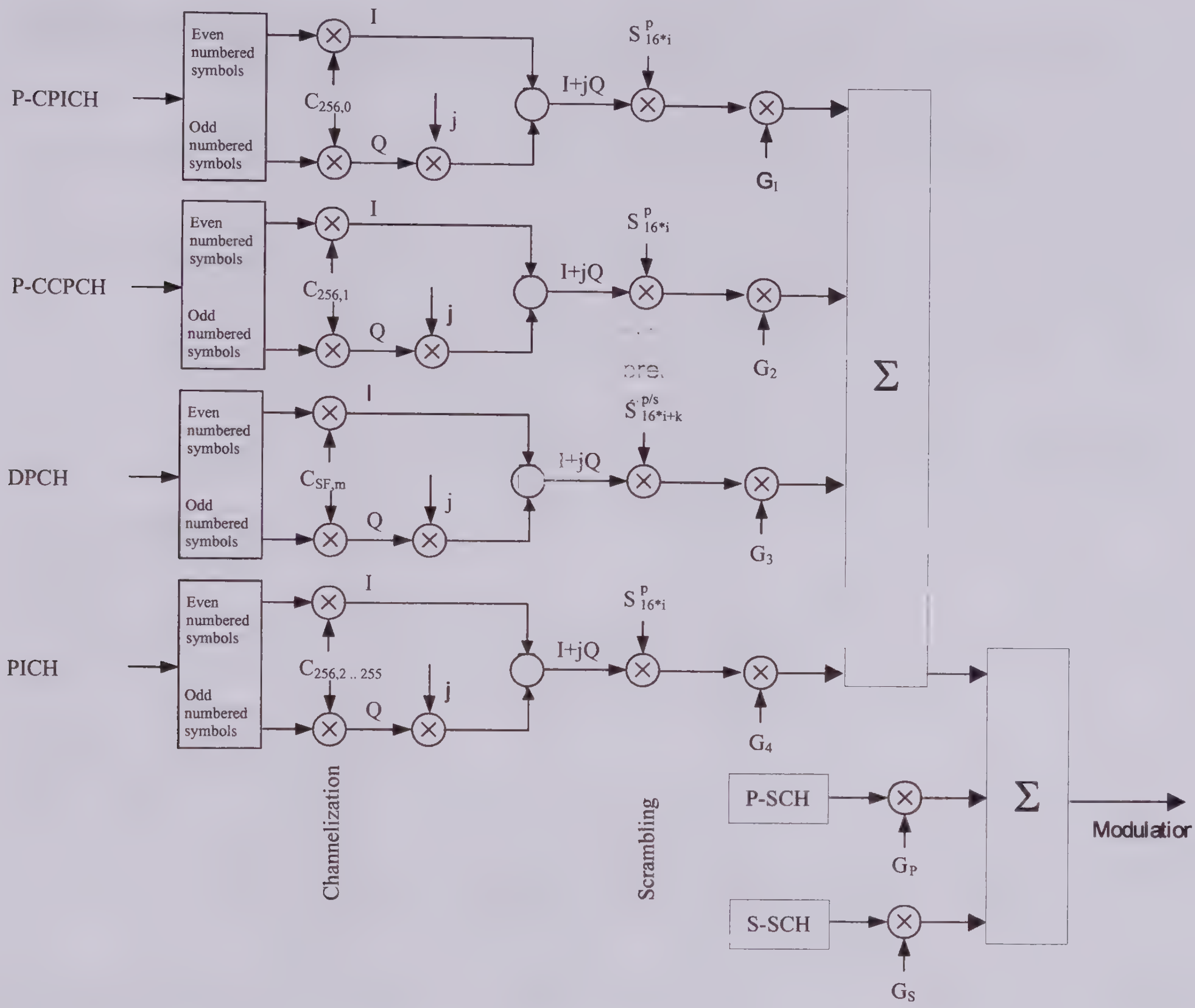

P-CPICH
P-CCPCH
DPCH
PICH
Even numbered symbols
Odd numbered symbols
I
Q
j
C256,0
C256,1
CSF,m
C256,2 .. 255
I+jQ
S p 16*i
S p/s 16*i+k
G1
G2
G3
G4
Σ
P-SCH
S-SCH
GP
GS
Modulation
Channelization
Scrambling

Fig. 4-52 Spreading of the downlink channels

With the channels of the CMU generator signal, synchronization of the UE is a three-step process:

1. **Slot synchronization**

The UE searches for the P-SCH and detects the primary synchronization code using correlation methods. The start of the P-SCH marks the beginning of a slot (see *Fig. 4-54* on p. 4.115).

2. **Frame synchronization and scrambling code group identification**

The UE detects the secondary synchronization code transmitted on the S-SCH to obtain the frame time and the scrambling code group. If needed, it also determines the System Frame Number (SFN) transmitted on the P-CCPCH.

1. **Scrambling code identification and data evaluation**

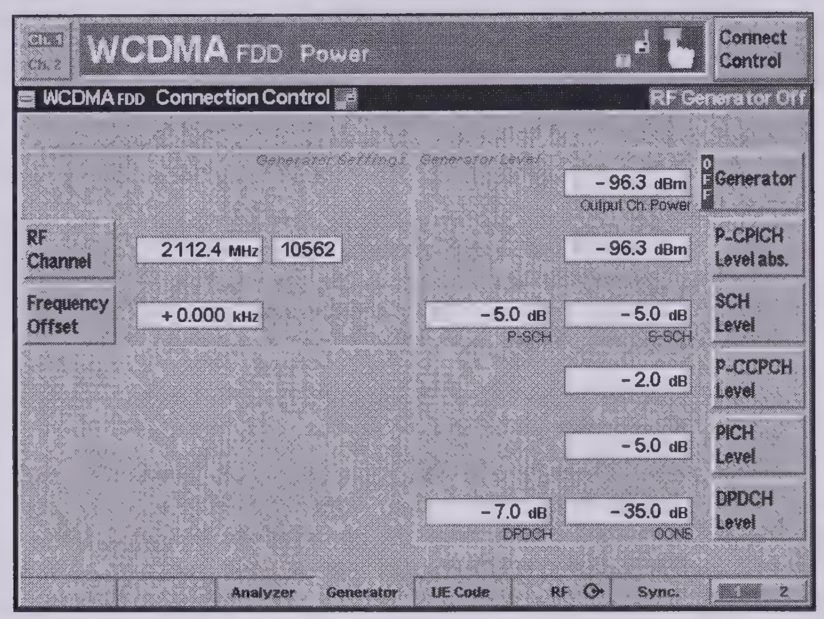
The UE detects the P-CPICH to determine the primary scrambling code within the scrambling code group obtained in step 2. Using this information, it is possible to detect the scrambling code of the DPCH and to decode the data.

Panel Oriented Version

The panel oriented version of the *Generator* tab provides softkeys used to

- Control the CMU's RF generator (Generator)
- Define the levels in the individual physical channels (*P-CPICH Level abs.* etc.)
- Define the *RF Channel* and *Frequency Offset* of the signal generated by the CMU *(Generator Settings* panel)

Connect Control →


Ch. 1
Ch. 2
WCDMA FDD Power
Connect Control
WCDMA FDD Connection Control
RF Generator Off
Generator Settings
Generator Level
Generator
P-CPICH Level abs.
SCH Level
P-CCPCH Level
PICH Level
DPDCH Level
RF Channel
Frequency Offset
Analyzer
Generator
UE Code
RF
Sync.
2

Output Ch. Power: - 96.3 dBm
RF Channel: 2112.4 MHz 10562
Frequency Offset: + 0.000 kHz
P-CPICH Level abs.: - 96.3 dBm
P-SCH: - 5.0 dB
S-SCH: - 5.0 dB
P-CCPCH Level: - 2.0 dB
PICH Level: - 5.0 dB
DPDCH: - 7.0 dB
OCNS: - 35.0 dB

Fig. 4-53 Connection Control – Generator (panel)

Generator

The *Generator* softkey indicates the operating status of the RF generator *(ON* or *OFF)*. Pressing the *Generator* softkey and the *ON/OFF* key switches the generator on or off.

The *Output Ch. Power* field shows the total output power of the RF generator in the RF channel, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits (see *TFCI State* on p. 4.120). The output power depends on the power settings of the individual physical channels (see softkeys *P-CPICH Level abs.* ff. below).

Remote control
```
INITiate:RFGenerator
ABORt:RFGenerator
FETCh:RFGenerator:STATus?
```

The properties and use of the following channels are described in section *Downlink Channels and Synchronization* on p. 4.110 ff.

P-CPICH Level abs.

The *P-CPICH Level abs.* softkey sets the absolute level of the Primary Common Pilot Channel (P-CPICH).

The P-CPICH is used as a reference for the total generator signal strength. It must be active in all generator signal configurations. In contrast, the DPCH channel can be switched off using the *ON/OFF* key or in the table-oriented version of the *Generator* menu.

Remote control
```
SOURce:RFGenerator:SChannel:LEVel:PCPich <Level>
```

`SOURce:RFGenerator:PHYSical:Level` sets all channel levels at once (recommended command)

SCH Level

The *SCH Level* softkey sets the level of the Primary Synchronization Channel (P-SCH) and the Secondary Synchronization Channel (S-SCH). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.118). The two levels can be entered in two separate input fields. If it is defined relative to the *P-CPICH Level abs.*, the *P-SCH Level* is equal to the ratio of the weighting factors G_p/G_1 in *Fig. 4-52* (see p. 4.112). The *S-SCH Level* is equal to the ratio of the weighting factors G_s/G_1 in *Fig. 4-52*.

The P-SCH carries a complex-valued 256-chip code c_p depending on the STTD encoding on the P-CCPCH and is used for slot synchronization between CMU and UE. It is time-multiplexed with the P-CCPCH as shown in *Fig. 4-54 below*.

The S-SCH carries a complex-valued 256-chip code $c^{k,i}{}_s$ depending on the slot no. i (i=0, 1, ... 14), the scrambling code group k (k = 0, 1, ..., 63; see background information on *Downlink scrambling codes* on p. 4.118), and the STTD encoding on the P-CCPCH. It is used for frame synchronization between CMU and UE. It is time-multiplexed with the P-CCPCH as shown in *Fig. 4-54 below*.

Remote control
```
SOURce:RFGenerator:SCHannel:LEVel:PSCH <Level>
SOURce:RFGenerator:SCHannel:LEVel:SSCH <Level>
```

P-CCPCH Level

The *P-CCPCH Level* softkey sets the level of the Primary Common Control Physical Channel (P-CCPCH). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.118). If it is defined relative to the *P-CPICH Level abs.*, the *P-CCPCH Level* is equal to the ratio of the weighting factors G_2/G_1 in *Fig. 4-52* (see p. 4.112).

The P-CCPCH carries the BCH transport channel and transmits the System Frame Number (SFN). It is used as the timing reference for all physical channels and is time-multiplexed with the SCHs as shown in *Fig. 4-54 below*.

Remote control
```
SOURce:RFGenerator:DBCHannel:LEVel:PCCPch <Level>
```

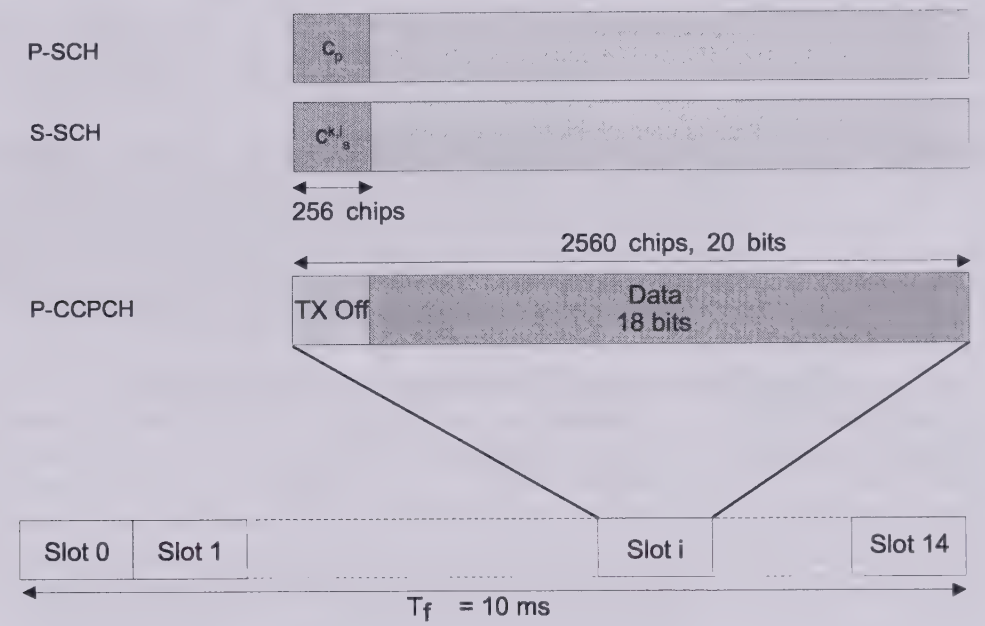


Fig. 4-54 Frame structure for the SCH and P-CCPCH

PICH Level

The *PICH Level* softkey sets the level of the Page Indicator Channel (PICH).). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.118). If it is defined relative to the *P-CPICH Level abs.*, the *PICH Level* is equal to the ratio of the weighting factors G_4/G_1 in *Fig. 4-52*.

The PICH is a fixed-rate (SF = 256) physical channel used to carry the paging indicators. All PICH bits are set to –1. The channelization code can be set in the table-oriented version of the *Generator* tab.

Remote control
`SOURce:RFGenerator:DBCHannel:LEVel:PICH <Level>`

DPDCH Level

The *DPDCH Level* softkey sets the level of the data part (DPDCH) of the Dedicated Physical Channel (DPCH). The level is set relative the *Output Channel Power* or to the *P-CPICH Level abs.*, depending on the selected *Level Reference* (see p. 4.118). The level of the control part can be set to be different from the *DPDCH Level;* see *Power Offset* parameter on p. 4.119. For a 0-dB power offset and if it is defined relative to the *P-CPICH Level abs.*, the *DPDCH Level* is equal to the ratio of the weighting factors G_3/G_1 in *Fig. 4-52* (see p. 4.112). The DPCH (including the DPCCH part) can be switched off by means of the *ON/OFF* key.

The *OCNS* input field sets the level of the Orthogonal Channel Noise Simulator (OCNS, see background information below) relative to the *P-CPICH Level abs.* The OCNS can be set if all levels are relative to the P-CPICH level *(Level Reference = PCPICH).* For *Level Reference = Output Channel Power* it is calculated automatically as the difference between the total output channel power and the individual physical channel contributions.

Further DPCH settings are provided in the table-oriented version of the *Generator* tab; see section *Downlink Physical Channel* on p. 4.172 ff. and *Fig. 4-57* on p. 4.123.

Remote control
`SOURce:RFGenerator:DBCHannel:LEVel:DPDCh <Level>`
`SOURce:RFGenerator:OCNS <Level>`

OCNS

The Orthogonal Channel Noise Simulator (OCNS) is used to simulate the users or control signals on the other orthogonal channels of a downlink. The DPCH Channelization Code and relative level settings for OCNS signals are specified in the terminal conformance specification 3GPP TS 34.121; see *Table 4-9 below*. The spreading factor of the OCNS signal is 128. The DPCH data for each channelization code are uncorrelated with each other and with any wanted signal over the period of any measurement. The parameters are chosen to simulate a signal with realistic Peak to Average Ratio.

Table 4-9 DPCH Channelization Code contributions of the OCNS signal

Channelization Code (SF = 128)	Relative Level Setting / dB	Channelization Code (SF = 128)	Relative Level Setting / dB
2	–1	62	–4
11	–3	69	–6
17	–3	78	–5
23	–5	85	–9
31	–2	94	–10
38	–4	125	–8
47	–8	113	–6
55	–7	119	–0

RF Channel

The *RF Channel* softkey defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal. The assignment between channel numbers *N* and carrier frequencies *F* is defined in the 3GPP specification (TS 34.121). The following relation holds for both directions of transmission (uplink and downlink) and all operating bands (I, II and III):

$$N = 5 \cdot (F / MHz), \quad 0.0\ MHz \le F \le 3276.6\ MHz$$

The CMU accepts the entry of frequency or channel number, provided that the assignment is unambiguous, i.e. that the channel number is assigned in one of the three operating bands and that it is calculated according to the formula quoted above. If the channel number is not assigned, the channel input field shows an invalid channel result "---".

In operating band II, 12 additional center frequencies are specified, which are shifted by 100 kHz relative to the normal raster, see *Table 4-6 above*. These channels must be selected with their channel numbers; it is not possible to enter frequencies off the 200 kHz raster.

It is possible, however, to enter arbitrary UARFCNs or RF frequencies outside the downlink bands, provided that the frequencies are in multiples of 200 kHz and within the specified range of the RF generator (see data sheet). Moreover, the generator frequency can be modified by an additional *Frequency Offset* entered by means of the softkey below so that any frequency within the specified range can be defined as a generator frequency.

Note: *The 100/200 kHz frequency raster of the UARFCN frequencies must not be confused with the much wider WCDMA carrier spacing of 5 MHz.*

Remote control
`UNIT:RFGenerator:FREQuency <Unit>`
`SOURce:RFGenerator:FREQuency <Frequency>`

Table 4-10 UTRA operating bands and channel numbers: Downlink

Operating Band	UL Frequency Band	Assigned Channels	Assigned Center Frequencies
I	2110 MHz to 2170 MHz	10562 to 10838	2112.4 MHz to 2167.6 MHz
II	1930 MHz to 1990 MHz	9662 to 9938, 412, 437, 462, 487, 512, 537, 562, 587, 612, 637, 662, 687	1932.4 MHz to 1987.6 MHz, 1932.5, 1937.5, 1942.5, 1947.5, 1952.5, 1957.5, 1962.5, 1967.5, 1972.5, 1977.5, 1982.5, 1987.5
III	1805 MHz to 1880 MHz	9037 to 9388	1807.4 MHz to 1877.6 MHz

Frequency Offset

The *Frequency Offset* softkey defines an offset for the frequency set under *RF Channel*. This enables an arbitrary modification or fine tuning of the generated frequency.

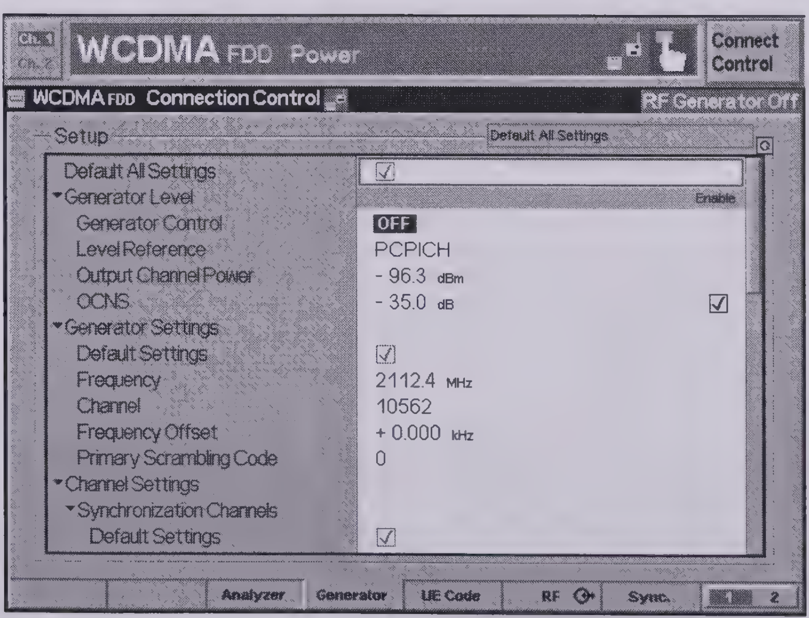
Remote control
`SOURce:RFGenerator:FOFFset <Number>`

Table Oriented Version

The table oriented version of the *Generator* tab provides settings to

- Control the RF generator *(Control)*
- Define channel-independent settings *(Generator Settings)*
- Configure the *Synchronization Channels*, the *Dedicated & Broadcast Channels*, the *3GPP DL Reference Channel*, and the *DL Physical Channel*
- Define the *TPC Profile* to be transmitted to the UE.

Connect Control →



Default All Settings	☑
Generator Level	
Generator Control	OFF
Level Reference	PCPICH
Output Channel Power	- 96.3 dBm
OCNS	- 35.0 dB ☑
Generator Settings	
Default Settings	☑
Frequency	2112.4 MHz
Channel	10562
Frequency Offset	+ 0.000 kHz
Primary Scrambling Code	0
Channel Settings	
Synchronization Channels	
Default Settings	☑

Fig. 4-55 Connection Control – Generator (table)

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *Generator* tab (the default values are quoted in the command description in chapter 6 of this manual). Further *Default Settings* switches are provided for several sections of the generator setup table.

Remote control
`DEFault:RFGenerator ON | OFF` etc.

Generator Level – Control

The *Generator Level* section indicates the generator state and defines the total generator power.

Control	Indicates whether the RF generator is switched on or off. The generator state can be changed by means of the *Generator* softkey in the panel oriented version of the *Generator* tab.
Level Reference	Defines whether the power of all channels and the OCNS is expressed relative to the P-CPICH *(PCPICH)* or to the *Output Channel Power.*
Output Ch. Power	Total output power of the BS signal, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits.
OCNS	Level of the Orthogonal Channel Noise Simulator (OCNS, see description on p. 4.115) relative to the *Output Channel Power* or to the *P-CPICH* level, depending on the selected *Level Reference.*

Remote control

```
FETCh:RFGenerator:STATus?
SOURCE:RFGenerator:LREFerence PCPich | OPOWer
SOURce:RFGenerator:OPOWer <Power>
SOURce:RFGenerator:OCNS <Power>
```

Generator Settings

The *Generator Settings* table section defines channel-independent properties of the generated RF signal:

Frequency	Carrier frequency of the generator signal (see *RF Channel* softkey description on p. 4.116)
Channel	UARFCN (see *RF Channel* softkey description on p. 4.116)
Frequency Offset	Frequency offset with respect to the carrier frequency
Primary Scrambling Code	Number of the primary scrambling code for the DL WCDMA signal. The scrambling code must be in the range 0 to 1FF (hex), corresponding to 0 to 511 decimal; see background information on *Downlink scrambling codes below.*

Remote control

```
SOURce:RFGenerator:FREQuency
UNIT:RFGenerator:FREQuency
SOURce:RFGenerator:FOFFSet
SOURce:RFGenerator:SCODe:PRIMary
```

Downlink scrambling codes

Downlink scrambling codes are used to separate different cells and users. According to standard 3GPP TS 25.213, the complex downlink scrambling codes are constructed by combining two real sequences generated by means of two generator polynomials of degree 18. Of these $2^{18} - 1$ scrambling codes, only a subset of 512 primary scrambling codes (numbered n = 16*i where i = 0 to 511) and 15*512 secondary codes (numbered n = 16*i + k where i = 0 to 511 and k = 1 to 15) are used. Hence the total number of primary and secondary codes is 8192.

The 512 primary scrambling codes is further divided into 64 groups, each consisting of 8 codes. The scrambling code group information is transmitted on the S-SCH; see *Fig. 4-54* on p. 4.115.

Each cell is allocated one and only one primary scrambling code. The P-CPICH, P-CCPCH and PICH are always transmitted using the primary scrambling code. The other downlink physical channels in the CMU generator signal can be transmitted with either the primary scrambling code or one of the secondary scrambling codes associated with the primary scrambling code of a cell.

Channel Settings Synchronization Channels

The *Channel Settings* table section defines channel-dependent properties of the RF signal. In the *Synchronization Channels* section, the level of the P-CPICH, the P-SCH and the S-SCH can be set; see *P-CPICH Level abs.* softkey on p. 4.113 and the following softkeys.

The P-CPICH is entered in absolute units (dBm) and is used as a reference for all other (relative) levels. Therefore the P-CPICH must be active in all generator signal configurations.

Remote control
`SOURce:RFGenerator:SCHannel:LEVel:PCPich`
`SOURce:RFGenerator:SCHannel:LEVel:PSCH`
`SOURce:RFGenerator:SCHannel:LEVel:SSCH`
`SOURce:RFGenerator:PHYSical:Level` sets all channel levels at once (recommended command)

Channel Settings Dedicated & Broadcast Channels

The *Dedicated & Broadcast Channels* section defines the level of the P-CCPCH, the PICH and the DPDCH. The DPCH (including the DPCCH part) can be switched off by unchecking the DPDCH *Enable* box. Besides, the following DPCH settings are provided:

PICH Channel. Code	Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the PICH. The PICH is a fixed rate (SF = 256) physical channel with channelization code numbers ranging from 2 to 255. The channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the PICH and the DPCH must be compatible; see background information on *PICH/DPCH channelization codes* on p. 4.120.
DPCH Channel. Code	Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the DPCH. The channelization code numbers depend on the spreading factors SF; they range from 0 to SF – 1. The spreading factors are given by the slot format (slot format numbers 0 to 16 for physical channels; see *Table 4-14* on p. 4.124 and slot format depending on the information bit rate for 3GPP reference measurement channels). The channelization codes $C_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the DPCH and the PICH must be compatible; see background information on *PICH/DPCH channelization codes* on p. 4.120.
Power Offset (DPCCH/DPDCH)	DPCCH power offset; relative power of the control part of the DPCH compared to the power in the data part (see *DPDCH Level* softkey on p. 4.115).

Secondary Scrambling Code	Number of the secondary scrambling code that is used to scramble the DPCH component of the WCDMA signal; see background information on *Downlink scrambling codes* on p. 4.118. The scrambling code must be in the range 0 to F (hex). The value 0 means that the primary scrambling code is used for the DPCH.
Dedicated Channel Mode	Configuration of the dedicated channel as a 3GPP downlink (DL) reference channel according to 3GPP TS 25.101 or as a physical channel. The parameters of both channel types are defined in the table sections below.
TFCI State	TFCI presence in the 3GPP downlink (DL) reference channel. The Transport Format Combination Indicator (TFCI) is optional; it may be present *(On)* or omitted *(Off)*. This setting is ignored if the dedicated channel is configured as a physical channel (see *Dedicated Channel Mode* above). In the *On* state, the TFCI bits of the 3GPP DL reference measurement channel are calculated according to the *TFCI Bits* setting; see below. In the *Off* state, DTX is used in all TFCI fields. The effect on the total generator output power is neglected (see section *Output Ch. Power*): The output power is always calculated for a continuous signal. A possible application of the *Off* state is to test the UE blind transport format detection.

Remote control

```
SOURce:RFGenerator:DBCHannel:LEVel:PCCPch
SOURce:RFGenerator:DBCHannel:LEVel:DPDCh
SOURce:RFGenerator:DBCHannel:LEVel:PICH
SOURce:RFGenerator:DBCHannel:PICH:CODE
SOURce:RFGenerator:DBCHannel:DPDCh:CODE
SOURce:RFGenerator:DBCHannel:POFFset <Level>
SOURce:RFGenerator:SCODe:SECondary
SOURce:RFGenerator:DBCHannel:DPDCh:MODE
SOURce:RFGenerator:DBCHannel:TSTate <Enable>
```

PICH/DPCH channelization codes

Channelization codes are used to separate different physical channels of the same carrier frequency, cell and user. They are defined in terms of the spreading factors SF and a code number k ranging from 0 to SF – 1. In the DL signal, a channelization code $c_{SF,\,k}$ must not be used more than once. Moreover, if a code $c_{m,\,n}$ is used, the codes $C_{m+1,\,2n}$, $c_{m+1,\,2n+1}$ are no longer available. The latter rule holds recursively so that a used channelization code with a small spreading factor bars many codes with larger spreading factors.

The spreading factor of the PICH is always 256 whereas the spreading factors of the DPCH vary between 4 and 512, depending on the slot format (see *Table 4-14* on p. 4.124). When a PICH or DPCH code number k is selected the CMU checks whether the corresponding channelization code is used by another channel or barred. If this is true k is corrected to the next possible value in ascending/descending direction, depending of the direction of the rollkey. If all codes larger (smaller) than k are barred, the largest (smallest) code number allowed is used. The CMU displays a message box *Value within an undefined interval will be corrected.*

The auto-correction of channelization codes is not active while the Orthogonal Channel Noise Simulator (OCNS) is switched on.

Channel Settings 3GPP DL Reference Channel

The *3GPP DL Reference Channel* section configures the 3GPP reference channel. According to 3GPP TS 25.101, the data content of the *3GPP DL Reference Channel* is defined on transport channel level. The data sequence to be transferred is directly fed into the Dedicated Traffic Channel (DTCH) and Dedicated Control Channel (DCCH). The transport channels are channel coded, multiplexed and mapped onto a Dedicated Physical Channel (DPCH) with variable data rate; see *Fig. 4-56 below.*

The downlink reference measurement channel generated in this way is to be used for various transmitter and receiver tests specified in standard 3GPP TS 25.101. The channel settings apply if the *Dedicated Channel Mode* parameter is set to *3GPP Reference*.

Reference Channel Type	Information bit rate of the reference channel (12.2 kbps, 64 kbps, 144 kbps, or 384 kbps). The information bit rate determines various physical and transport channel parameters of the reference channel. An example (12.2 kbps) is given in *Table 4-12* and *Table 4-13 below*.
Channel Data Source DTCH	Bit pattern transmitted as user information on the DTCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15).*
Channel Data Source DCCH	Fixed *All 0* bit pattern transmitted on the DCCH.
TFCI Bits	Code number between 0 and 3 for the TFCI bit sequence. The TFCI labels four different configurations of the standard 3GPP DL reference measurement channel; see background information below.

The Transport Format Indicator (TFI) is a label for a specific transport format of a transport channel (TrCH). If several TrCHs are multiplexed in one transport bearer, each of them carries its own TFI defining the number and size of transport blocks in the TrCH.

To facilitate signalling of the individual TFIs, they are combined to an integer code number, the Calculated Transport Format Combination (CTFC). The CTFC is uniquely defined by the TFIs of the individual TrCHs in the transport bearer (see standard 3GPP TS 25.331). On the other hand, the individual TFIs can be resolved from the CTFC, the total number of TrCHs, and the number of TFIs for each TrCH.

For a given TrCH configuration, the CTFC list contains a definite number, say n, of distinct, integer numbers ≥ 0. These n CTFC values are mapped to a set of Transport Format Combination Index (TFCI) values comprising all integer numbers between 0 and $n - 1$. The one-to-one mapping between the CTFC and the TFCI values is always the same in the node B and in the UE so that CTFC and TFCI values are equivalent.

The 3GPP DL reference measurement channel contains two TrCHs, one of them carrying the DTCH, the other carrying the DCCH (see *Fig. 4-56 below*). Both channels can be configured either with the transport block size defined in the standard (see *Table 4-13 below*) or as an empty channel with transport block size 0[1] according to standard 3GPP TS 25.331. The four possible combinations translate into a TFCI range between 0 and 3.

The CMU uses TFI = 1 for empty TrCHs and the fixed assignment between CTFC and TFCI values listed in *Table 4-11 below*. This means that TFCI = 3 identifies the standard 3GPP DL reference measurement channel with no empty transport channels.

Remote control
`SOURce:RFGenerator:RCHannel...`

---

[1] To generate an empty channel, the CMU replaces the data bits in the transport block by DTX bits (discontinuous transmission). These empty data blocks are channel coded according to the standard scheme of Fig. 4-56.

Table 4-11 TFCI assignment in the CMU

TFI_1	TFI_2	CTFC	TFCI
1 (empty $TrCH_1$)	0 (standard $TrCH_2$)	1*1 + 0*2 = 1	0
0 (standard $TrCH_1$)	1 (empty $TrCH_2$)	0*1 + 1*2 = 2	1
1 (empty $TrCH_1$)	1 (empty $TrCH_2$)	1*1 + 1*2 = 3	2
0 (standard $TrCH_1$)	0 (standard $TrCH_2$)	0*1 + 0*2 = 0	3

The following example illustrates the generation of a 3GPP reference measurement channel from the DTCH and DCCH transport channels and the parameters for an information bit rate of 12.2 kbps. For other bit rates refer to standard 3GPP TS 25.101.

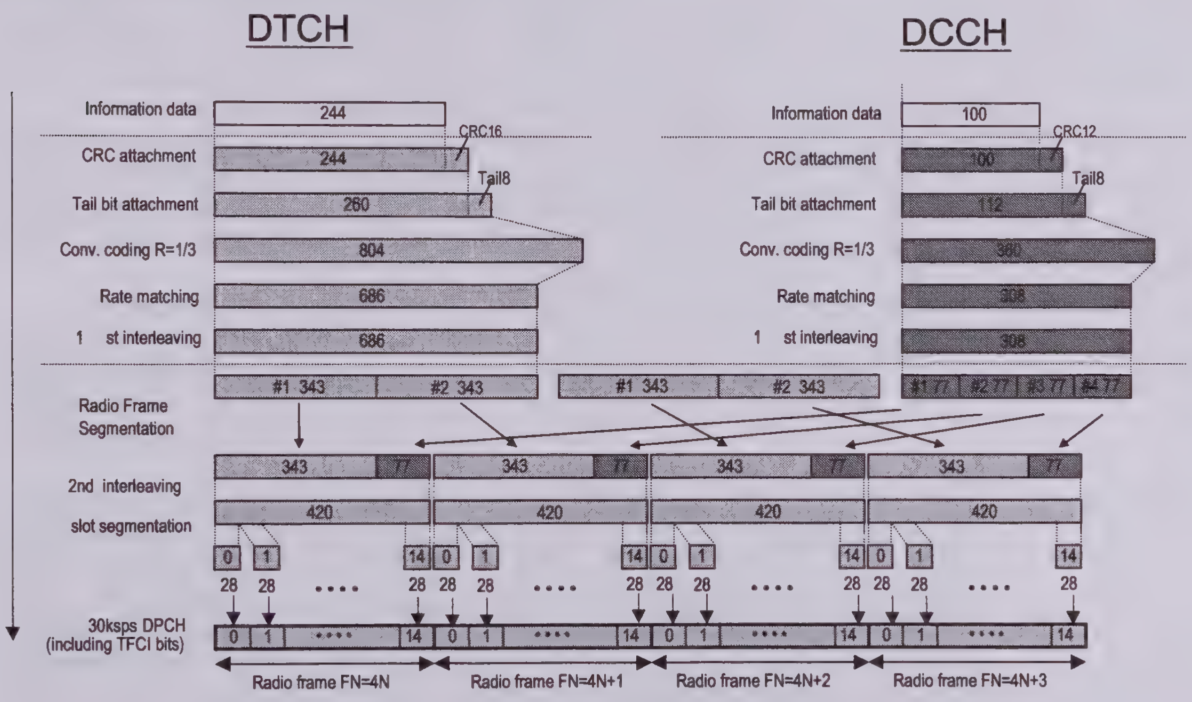

DTCH
DCCH
Information data
244
100
CRC16
CRC12
CRC attachment
Tail8
Tail bit attachment
260
112
Conv. coding R=1/3
804
360
Rate matching
686
308
1 st interleaving
#1 343
#2 343
#1 77
#2 77
#3 77
#4 77
Radio Frame Segmentation
343
77
2nd interleaving
420
slot segmentation
0
1
14
28
30ksps DPCH (including TFCI bits)
Radio frame FN=4N
Radio frame FN=4N+1
Radio frame FN=4N+2
Radio frame FN=4N+3

Fig. 4-56 Channel coding of DL reference measurement channel (12.2 kbps)

Table 4-12 DL reference measurement channel, physical parameters (12.2 kbps)

Parameter	Level	Unit
Information bit rate	12.2	kbps
DPCH	30	ksps
Slot Format #i	11	-
TFCI	On	-
Power offsets PO1, PO2 and PO3	0	dB
Puncturing	14.7	%

Table 4-13 DL reference measurement channel, transport channel parameters (12.2 kbps)

Parameter	DTCH	DCCH
Transport Channel Number	1	2
Transport Block Size	244	100
Transport Block Set Size	244	100
Transmission Time Interval	20 ms	40 ms
Type of Error Protection	Convolution Coding	Convolution Coding
Coding Rate	1/3	1/3
Rate Matching attribute	256	256
Size of CRC	16	12
Position of TrCH in radio frame	fixed	fixed

Channel Settings DL Physical Channel

The *DL Physical Channel* section defines the properties of the physical channel. The *DL Physical Channel* is defined in terms of its slot format. The data sequence to be transferred is fed into the data fields of the DPDCH without channel coding. The DPDCH is time-multiplexed with the DPCCH according to standard 3GPP TS 25.211. If any TFCI bits are used (see *TFCI State* on p. 4.120), all of them are set to 0. The channel settings apply if the *Dedicated Channel Mode* parameter is set to *Physical*.

Slot Format	Slot format number determining the properties of the DL physical channel. The CMU supports all slot formats 0 to 16; the corresponding channel parameters are listed in *Table 4-14 below*.
Data Source	Bit pattern transmitted as user information on the DPDCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15)*.

Remote control
`SOURce:RFGenerator:PCHannel...`

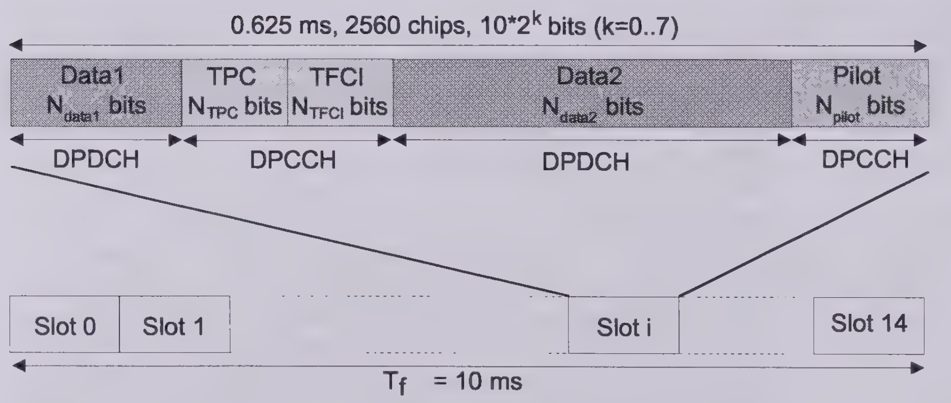


Fig. 4-57 Structure of an downlink DPCH in time domain

DPCCH	Dedicated Physical Control Channel
DPDCH	Dedicated Physical Data Channel
TFCI	Transport Format Combination Indicator
TPC	Transmit Power Control

Table 4-14 Downlink DPDCH and DPCCH slot formats

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	DPDCH Bits/Slot		DPCCH Bits/Slot			Transmitted slots per radio frame N_{Tr}
					N_{Data1}	N_{Data2}	N_{TPC}	N_{TFCI}	N_{Pilot}	
0	15	7.5	512	10	0	4	2	0	4	15
1	15	7.5	512	10	0	2	2	2	4	15
2	30	15	256	20	2	14	2	0	2	15
3	30	15	256	20	2	12	2	2	2	15
4	30	15	256	20	2	12	2	0	4	15
5	30	15	256	20	2	10	2	2	4	15
6	30	15	256	20	2	8	2	0	8	15
7	30	15	256	20	2	6	2	2	8	15
8	60	30	128	40	6	28	2	0	4	15
9	60	30	128	40	6	26	2	2	4	15
10	60	30	128	40	6	24	2	0	8	15
11	60	30	128	40	6	22	2	2	8	15
12	120	60	64	80	12	48	4	8	8	15
13	240	120	32	160	28	112	4	8	8	15
14	480	240	16	320	56	232	8	8	16	15
15	960	480	8	640	120	488	8	8	16	15
16	1920	960	4	1280	248	1000	8	8	16	15

If TFCI bits are not used, the CMU always uses DTX in the TFCI field.

TPC Settings

The *TPC Settings* section defines the inner loop Transmit Power Control (TPC) information transmitted on the DPCH. The CMU provides five different predefined setups with different TPC patterns. It is possible to select one of these TPC patterns or modify each pattern according to the needs of a specific application.

TPC Pattern Setup

Selects the TPC pattern setup to be used. All setups no. 01 to 05 are defined by the *TPC Pattern Type* and the single *Pattern;* see *Table 4-15* below. .

TPC Pattern Type

TPC command sequence transferred to the UE. Together with the power control algorithm set at the UE, the TPC profile determines the power steps of the UE transmitter between consecutive slots. The timing of the TPC pattern is trigger-controlled. In order to meet the periodicity conditions for inner loop power control, the start of the pattern always coincides with the beginning of a frame. For more information on the inner loop TPC measurement refer to section *Power Measurements* on p. *4.2* ff.

The actual pattern transferred depends on the finite single *Pattern* defined below, the *TPC Pattern Type* and the *Repeat Pattern* setting*;* see *Table 4-16* and rules for the transfer of TPC patterns *below.*

Pattern

TPC command sequence of finite length (single pattern) used to construct the pattern transferred to the UE; see *TPC Pattern Type* above.

Repeat Pattern	Enabled for *TPC Pattern Type = Single Pattern + All 0, Single Pattern + All 1* or *Single Pattern + Alternating.* Selecting *On* terminates the running alternating bit sequence at the next matching frame boundary and replaces it by <Pattern>000..., <Pattern>111..., or <Pattern>(0)10010...; see *Table 4-16 and rules for the transfer of TPC patterns below.* The function is afterwards switched back to the *Off* state. The function can be used repeatedly to insert single patterns into the bit sequence and test the inner loop TPC.
Note:	*If the CMU measures the uplink signal of an UE transmitter that is stimulated to change its output power (e.g. in an* Inner Loop TPC *measurement), the input path configuration, in particular the* Max. Level *setting (see section Analyzer Settings (Connection Control – Analyzer) on p. 4.105 ff.), must be adapted to the expected maximum power. This can be done using autoranging. The transmitter output power must be compatible with the input level range of the CMU input connectors.*

Remote control
`SOURce:RFGenerator:TPC:PSET<nr>`
`SOURce:RFGenerator:TPC:PTYPe<nr>`
`SOURce:RFGenerator:TPC:PATTern<nr>`
`DEFault:RFGenerator:TPC`
`SOURce:RFGenerator:TPC:RPATtern`

Table 4-15 Default TPC Patterns

Setup No.	**TPC Pattern Type**	**Pattern**	**Description**
1	Alternating 0, 1	0101010101 0101010101	UE maintains its power (averaged over 2 slots).
2	Continuous Pattern	1111100000 1111100000	UE periodically increases and decreases its output power in 5-slot intervals. The average UE power over 10 slots is constant irrespective of the TPC algorithm.
3	Single Pattern + All 0	1111111111 1111111111	UE increases its output power on each <Repeat Pattern> event; otherwise it decreases its power up to its minimum power level.
4	Single Pattern + All 1	0000000000 0000000000	UE decreases its output power on each <Repeat Pattern> event; otherwise it increases its power up to its minimum power level.
5	Single Pattern + Alternating	1111111111 0000000000	On each <Repeat Pattern> event, the UE increases and decreases its output power in 10-slot intervals. The average UE power over 20 slots is constant irrespective of the TPC algorithm.

Table 4-16 Single pattern and TPC Pattern Type: Non Signalling

TPC Pattern Type	**Transferred pattern for a single pattern <Pattern>**	**Trigger events**
Alternating 0, 1	101010... (if last bit in current frame/before the start of the pattern is 0) 010101... (if last bit in current frame/before the start of the pattern is 1)	10-slot raster, frame-aligned in every 2nd frame
All 0	000000... (irrespective of <Pattern>)	10-slot raster, frame-aligned in every 2nd frame
All 1	111111... (irrespective of <Pattern>)	10-slot raster, frame-aligned in every 2nd frame

TPC Pattern Type	Transferred pattern for a single pattern <Pattern>	Trigger events
Continuous Pattern	<Pattern><Pattern><Pattern><Pattern>...	Trigger event at the beginning of each <Pattern>
Single Pattern + All 0	010101(0)<Pattern>000... (<Pattern> must be triggered by *Repeat Pattern* event) The first bit of Pattern is always different from the last alternating bit.	See *All 0*[2]
Single Pattern + All 1	010101(0)<Pattern>111... (<Pattern> must be triggered by *Repeat Pattern* event) The first bit of Pattern is always different from the last alternating bit.	See *All 1*[2]
Single Pattern + Alternating	010101(0)<Pattern>(0)10101... (<Pattern> triggered by *Repeat Pattern*) The first bit of Pattern is always different from the last alternating bit.; the first bit after <Pattern> is always different from the last bit in <Pattern>	See *Alternating 0, 1*[2]

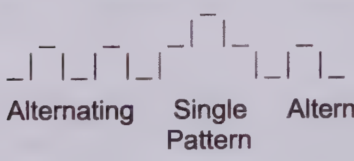
Rules for the transfer of TPC patterns:

- A new pattern following an *All 0* or *All 1* pattern starts at the beginning of the first frame after the current frame.
- A new pattern following an *Alternating* pattern always starts at the next frame boundary where the last bit of the *Alternating* pattern is different from the first bit of the new pattern. This may be the first or second frame after the current frame.
- A running *Continuous Pattern* is immediately interrupted by a new pattern. The new pattern starts at the beginning of the first frame after the current frame.

Example: Single Pattern + Alternating *can be used to first change the (average) UE power by a definite number of steps and then maintain the new (average) UE power. Due to the rules quoted above, the first and the last bit in <Pattern> cancel the effect of the preceding and the following bits. The rules tend to stabilize the net UE power and minimize the effect of <Pattern>.*

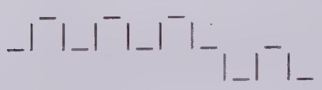
It is easy to show this mechanism for power control algorithm 1 where the UE power changes after each slot by a definite Step Size*: If the first and the last bits in <Pattern> are different, the net UE power change caused by these bits is zero. If both the first and the last bit in <Pattern> are 1 (0), then the net UE power change caused by these 2 bits equals to the step size times 1 (–1); the effect of one bit is cancelled. In contrast, each of the central 0 and 1 bits in <Pattern> (i.e. all bits except the first and the last bit) causes a UE power change of the step size times –1 and 1, respectively.*

a) 1st and last bit in <Pattern> different



Pattern: 1 1 0 0
<- Net UE power unchanged

b) 1st and last bit in <Pattern> equal



Pattern: 0 0
<- Net UE power change: –1 x <Step_Size>

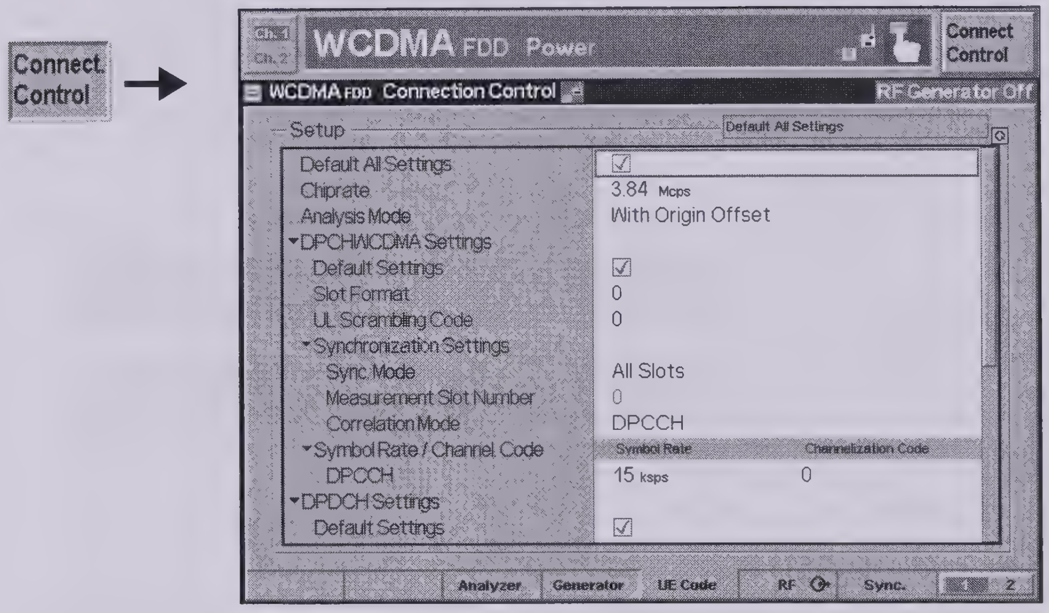
---

[2] *Repeat Pattern* causes a trigger event for the transmission of <Pattern>. See *Rules for the transfer of TPC patterns.*

Uplink Signal (Connection Control – UE Code)

The *UE Code* tab defines the properties of the uplink WCDMA signal that the CMU is able to analyze and configures the measurement. This includes the setting of:

- The *Chip Rate* of the WCDMA signal
- Inclusion of a possible origin offset in the measurement results *(Analysis Mode)*
- The properties of the Dedicated Physical Channel *(DPCH WCDMA Settings)*
- The properties of the Dedicated Physical Data Channel *(DPDCH Settings)*



Default All Settings	☑	
Chiprate	3.84 Mcps	
Analysis Mode	With Origin Offset	
▾DPCH/WCDMA Settings		
Default Settings	☑	
Slot Format	0	
UL Scrambling Code	0	
▾Synchronization Settings		
Sync Mode	All Slots	
Measurement Slot Number	0	
Correlation Mode	DPCCH	
▾Symbol Rate / Channel Code	Symbol Rate	Channelization Code
DPCCH	15 ksps	0
▾DPDCH Settings		
Default Settings	☑	

Fig. 4-58 Connection Control – RF connectors

Default Settings The *Default All Settings* switch assigns default values to all settings in the *UE Code* tab (the default values are quoted in the command description in chapter 6 of this manual). In addition, default switches for the individual channel types are provided.

Remote control
`DEFault:UECode:DPCH ON | OFF` etc.

Chip rate The *Chip rate* field indicates the fixed chip rate of the analyzed WCDMA signal (3.84 Mcps).
Remote control
No command, indicated constant value only.

Analysis Mode The *Analysis Mode* parameter selects whether a possible origin offset is included in the measurement results or subtracted out. The analysis mode has an impact on most of the parameters determined in a *Modulation* measurement and on the modulation (EVM) results indicated in the *Code Domain Power* menus.

With Origin Offset The modulation vectors R and Z in *Fig. 4-10* are measured from the origin of the I/Q plane, so the results for the *EVM*, *Phase Error* and *Magnitude Error* include a possible origin offset. This mode conforms to 3GPP specifications,

Without Origin Offset The modulation vectors R and Z in *Fig. 4-10* are measured from the coordinates of the I/Q offset vector, so the origin offset is subtracted out in the *EVM*, *Phase Error* and *Magnitude*

Error results.

Note: *The* I/Q Imbalance *is always calculated without origin offset regardless of the* Analysis Mode *set (see Fig. 4-11). Conversely, the* Waveform Quality, *the* Peak Code Domain Error, Code Domain Power (CDP) *and* CDP Rho *are always calculated with origin offset.*

Remote control

`CONFigure:UECode:AMODe WOOFfset | WIOFfset`

DPCH WCDMA Settings

The *DPCH WCDMA Settings* table section configures the uplink Dedicated Physical Channel (DPCH) and the conditions for the *WCDMA Modulation* measurement described on p. *4.45* ff. and for *Code Domain Power* measurement described on p. *4.78* ff. The DPCH is a traffic channel for transmission of voice or user data consisting of multiple parallel (code and I/Q-multiplexed) variable rate services (one DPCCH plus up to 6 DPDCHs; see *Fig. 4-13*). If only one DPDCH is allocated, it has the following structure:

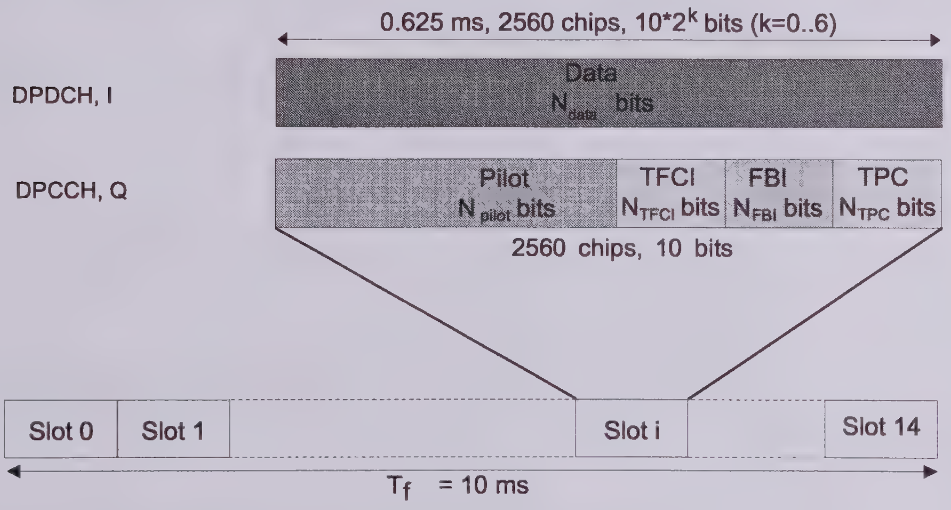

0.625 ms, 2560 chips, 10*2^k bits (k=0..6)
DPDCH, I
Data
N_data bits
DPCCH, Q
Pilot
N_pilot bits
TFCI
N_TFCI bits
FBI
N_FBI bits
TPC
N_TPC bits
2560 chips, 10 bits
Slot 0
Slot 1
Slot i
Slot 14
T_f = 10 ms

Fig. 4-59 Structure of an uplink DPCH in time domain

DPCCH	Dedicated Physical Control Channel
DPDCH	Dedicated Physical Data Channel
TFCI	Transport Format Combination Indicator
FBI	Feedback Information
TPC	Transmit Power Control
Pilot	Pilot Symbols

Slot Format Uplink DPCCH slot format in the range between 0 and 5. The slot format defines the length of the individual data fields in the DPCCH; see *Table 4-17 below.*

Table 4-17 Uplink DPCCH slot formats

Slot Format #i	Channel Bit Rate (kbps)	Channel Symbol Rate (ksps)	SF	Bits/ Slot	N_{Pilot}	N_{TPC}	N_{TFCI}	N_{FBI}	Transmitted slots per radio frame
0	15	15	256	15	6	2	2	0	15
1	15	15	256	15	8	2	0	0	8 to 15
2	15	15	256	15	5	2	2	1	15
3	15	15	256	15	7	2	0	1	8 to 15
4	15	15	256	15	6	2	0	2	8 to 15
5	15	15	256	15	5	1	2	2	15

Scrambling Code Number of the long code that is used to scramble the uplink WCDMA signal; see *Fig. 4-13*. The scrambling code number must be in the range 0 to FFFFFF (hex) corresponding to 0 to 16777215 decimal.

Sync. Mode Method that the CMU uses to synchronize to the captured (channel coded and scrambled) uplink WCDMA signal and analyze the slot number.

In the *All Slots* mode, the measured slot number is random (0 ≤ meas. slot number ≤ 14). The CMU performs a correlation analysis of the captured signal to detect the start of the slot and then deduces the slot number from the pilot bits. The detected slot number is displayed in the *WCDMA Modulation* and *Code Domain Power* measurement menus and generally varies from one measurement cycle to another.

In the *Synchronous* mode, the measurement is performed under the assumption that the slot number of the captured signal is as specified by *Measurement Slot Number;* see below. The beginning of the slot is searched in a symmetric time range around the specified point, which is given by the trigger time plus the defined trigger delay plus the *Measurement Slot Number* (see *Fig. 4-60 below*). The search range covers ±380 chip periods from the specified point and is thus much smaller than that of the *All Slots* mode so that the *Synchronous* measurement is faster. The trigger must be set as explained below.

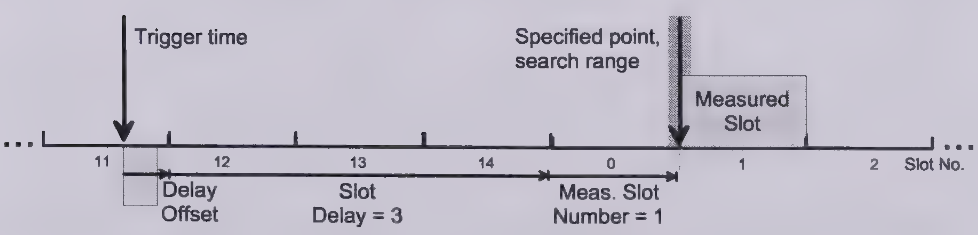


Fig. 4-60 Measured slot in Synchronous mode

Trigger settings in *Synchronized* mode:

In the *Synchronized* mode the beginning of the measured slot can be detected only if it is inside the search range around the specified point (see *Fig. 4-60 above*). Furthermore, the slot must be in accordance to the *Measurement Slot Number* settings.

This implies that the CMU must be configured as follows:

- Select *External* trigger with a frame-periodic trigger signal or *Internal* trigger (see trigger settings on p. 4.136; *Synchronous* mode with *Free Run* trigger is not possible).
- Use the trigger delay parameters to compensate for a delay between the trigger time and the beginning of the next uplink frame. If the delay amounts to n integer slots plus approx. k chip periods, then select *Slot Delay = n* and *Delay Offset = k*. The corrected trigger time approximately coincides with the beginning of the frame (frame trigger).

The CMU will detect the start of the measured slot and perform measurements for arbitrary *Measurement Slot Number* settings. If the trigger time is not correctly set, the CMU is unable to synchronize to the UL WCDMA signal and generates an error message *Scrambling code or slot format does not match input signal.*

Meas. Slot Number	Slot number to be measured in the range 0 to 14. The CMU expects this slot to be captured if *Sync. Mode* is set to *Synchronous*. The *Meas. Slot Number* is displayed in the *WCDMA Modulation* and *Code Domain Power* measurement menus. In the *All Slots* mode, the *Measured Slot Number* is ignored.
Correlation Mode	Defines which DPCH contributions are used for the correlation analysis. The *DPCCH + DPDCH* mode improves the reception of the UE signal, especially if a large frequency offset occurs or if the DPCCH level is much smaller than the DPDCH level. On the other hand the DPCCH mode accelerates the measurement.
Symbol Rate/Channel. Code DPCCH	Indication of the fixed symbol rate of 15 ksps and the fixed channelization code 0 of the Dedicated Physical Control Channel; see explanation of channelization codes in section *Measurement Menu (Modulation WCDMA)* on p. *4.45* ff. The symbol rate and channelization code settings are ignored if the *DPDCH CC Mode* in the *Modulation* menu is set to *Auto* and in the *CDP ... Auto* applications.

Note: *An error message* Scrambling code or slot format does not match input signal. *is displayed if the CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the* Scrambling Code *or the* Slot Format *set. At the same time bit no. 13 in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-register is set.*

Remote control

```
CONFigure:UECode:DPCH:SFORmat <Number>
CONFigure:UECode:DPCH:SCODe <Code>
CONFigure:UECode:DPCH:CMODe <Mode>
CONFigure:UECode:DPCH:SYMode <Mode>
```

DPDCH Settings The *DPDCH Settings* table section configures the Dedicated Physical Data Channels (DPDCH) that contribute to the multiple WCDMA signal; see section *Measurement Menu (Modulation WCDMA)* on p. *4.45* ff.

Auto Settings: The *Auto Settings* section defines the conditions of the channelization code search that is activated by setting the *DPDCH CC Mode* in the *Modulation* menu to *Auto* or by activating one of the *CDP ... Auto* applications. The *Auto Settings* are ignored if *DPDCH CC Mode* is set to *Manual* or in the *CDP ...*

	Manual applications.
DPDCH Symbol Rate	Symbol rate of the DPDCH. The CMU analyzes the WCDMA signal assuming it to have the set symbol rate and derives its channelization codes according to the specified properties; see section *Measurement Menu (Modulation WCDMA)* on p. *4.45* ff.
Threshold	Minimum signal strength of each DPDCH$_n$ in the WCDMA signal to be detected in the automatic channelization code search. The threshold is defined as a ratio of the individual DPDCH$_n$ to the DPCCH and expressed in dB. If DPDCH$_n$/DPCCH < Threshold, DPDCH$_n$ is not detected. The power threshold is important to distinguish the DPDCH from unwanted signals, e.g. noise or non-orthogonal components that may be detected as fictitious DPDCHs. A low threshold value represents a weaker selection criterion and increases the risk of detecting unwanted signals. On the other hand a high threshold may prevent the real DPDCH signals from being detected and cause a failure of the channelization code search.
Manual Settings:	The *Manual Settings* section defines the properties of the multiple WCDMA signal that can be analyzed if the *DPDCH CC Mode* in the *Modulation* menu is set to *Manual* or if one of the *CDP ... Manual* applications is active. The *Manual Settings* are ignored if *DPDCH CC Mode* is set to *Auto* or in the *CDP ... Auto* applications.
Multiple Signal	Selection of the code channels (physical channels) that contribute to the multiple uplink WCDMA signal. In the *DPCCH* setting, the signal consists of one single Dedicated Physical Control Channel. In the *DPCCH + DPDCH1,...,n* setting, the signal consists of one DPCCH to which n Dedicated Physical Data Channels are added. n can vary between 1 and 6 so that it is possible to superimpose up to 7 signals as shown in *Fig. 4-13.*
Symb. Rate/C. Code	*Channel.*Table of the symbol rate and channelization code for each of the six CPDCHs that can contribute to the multiple WCDMA signal. If a *DPCCH+DPDCH1* multiple signal is analyzed, the symbol rate of the data channel *DPDCH1* can be set; the channelization code will be automatically adapted according to the rules in the 3GPP standard. For other multiple signal configurations, symbol rates and channelization codes are fixed.

Remote control

```
CONFigure:UECode:DPDCh:AUTO:SRATe <Rate>
CONFigure:UECode:DPDCh:AUTO:THReshold <THReshold>
CONFigure:UECode:DPDCh:MANual:MSIGnal <Channels>
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode <Channels>
```

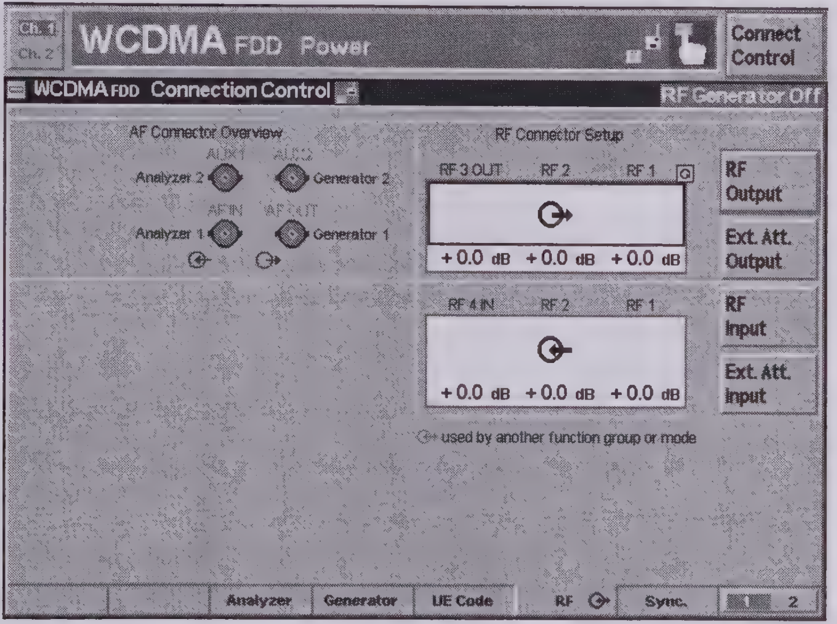
RF Connectors (Connection Control – RF Connectors)

The popup menu *RF* ⊖→ configures the RF connectors of the CMU. This includes selection of

- The RF input and output of the CMU (RF Output, RF Input)
- An external attenuation at the connectors (Ext. Att. Output, Ext. Att. Input)

The name and function of the AF connectors is indicated in addition. The configuration of the output connectors is relevant only if option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator,* is available.

Connect Control →



Ch. 1
Ch. 2
WCDMA FDD Power
Connect Control
WCDMA FDD Connection Control
RF Generator Off
AF Connector Overview
AUX 1
AUX 2
Analyzer 2
Generator 2
AF IN
AF OUT
Analyzer 1
Generator 1
RF Connector Setup
RF 3 OUT
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
RF 4 IN
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
used by another function group or mode
RF Output
Ext. Att. Output
RF Input
Ext. Att. Input
Analyzer
Generator
UE Code
RF
Sync.
2

Fig. 4-61 Connection Control – RF connectors

AF Connector Overview

The *AF Connector Overview* shows the destination of the input signals fed in via AF IN and AUX 1 and the signal sources for the two audio output connectors AF OUT and AUX 2. In contrast to the *Signalling* test mode (see section *AF/RF Connectors* on p. 4.180 ff.), the routing of input and output signals is fixed: The connectors AF IN and AF OUT are used as input and output for the primary audio circuit (Analyzer 1, Generator 1). AUX 1 and AUX 2 are used as input and output for the secondary audio circuit (Analyzer 2, Generator 2).

Audio measurements on the CMU can be performed with option CMU-B41, *Audio Generator and Analyzer.* For more information refer to section *Audio Measurements* on p. 4.104 ff. and to the CMU 200/300 operating manual.

RF Output

The *RF Output* softkey defines which of the three connectors RF 1, RF 2 and RF 3 OUT is to be used as RF output connector. A symbol indicates the selected RF output.

Note: *Input and output connectors can be arbitrarily combined. The bidirectional connectors RF 1 and RF 2 can be selected as RF inputs and outputs at the same time.*

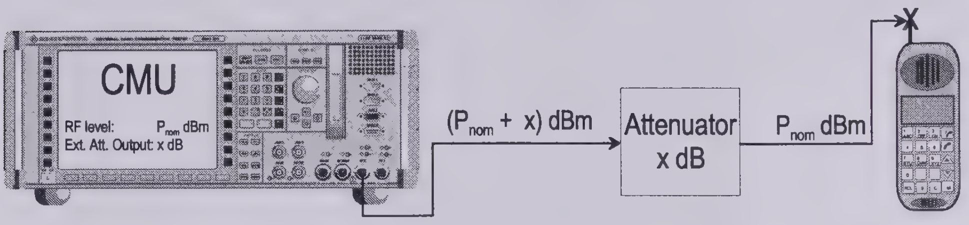
The LEDs on the front panel are only „on" (light) if the output level is switched on.

Remote control
`OUTPut[:STATe] RF1 | RF2 | RF3`

Ext. Att. Output

The softkey *Ext. Att. Output* defines an external attenuation (or gain, if the value is negative) at the selected RF output. Input of an external attenuation is suitable, for example, if a path attenuation (cable) is included in the test setup, which is to be corrected by an increased signal level.

If an external attenuation is defined, the output signal level is referred to the input of the DUT, the generator level is therefore shifted with respect to the actual level at the input connector of the CMU. The default value for the generator power and the level ranges for the RF outputs are also shifted provided that the generator can output the required power, compensating for the external attenuation or gain. Otherwise it is adapted to the level closest to the shifted default value



Remote control
`[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]`
`SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]`

RF Input

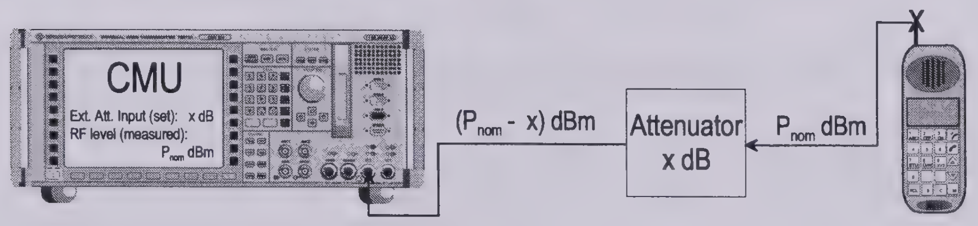
The *RF Input* softkey determines which of the three connectors RF 1, RF 2 and RF 4 IN is to be used as RF input connector. If a connector is selected as RF input, a symbol will appear in the respective field. Input and output connectors can be arbitrarily combined.

Remote control
`INPut[:STATe] RF1 | RF2 | RF4`

Ext. Att. Input

The softkey *Ext. Att. Input* enters the value of the external attenuation (or gain) at the selected RF input. Input of an external attenuation is required if, for example, external attenuator pads are used for protection of the sensitive RF inputs of the CMU or if a path attenuation is included in the test setup.

If an external input attenuation is reported to the instrument (see section *RF Connectors (Connection Control – RF Connectors)* on page 4.107), all levels measured are referred to the output of the DUT and therefore shifted with respect to the actual level at the input connectors of the CMU. The level ranges for the input connectors are shifted as well.



Note: The LEDs on the front panel are only "on" (light) if the measurement is active.

Remote control
`[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]`
`SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]`

Reference Frequency (Connection Control – Sync.)

The popup menu *Sync.* defines the reference signals for synchronization. This includes

- The internal or external Reference Frequency
- The output mode for the network-specific system clock (REF OUT 2)

Connect Control →

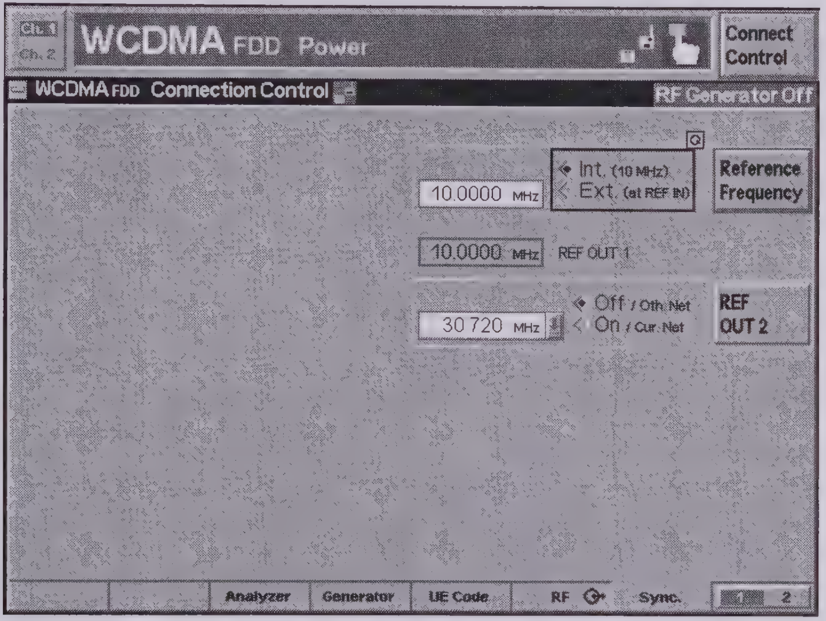

Ch. 1
Ch. 2
WCDMA FDD Power
Connect Control
WCDMA FDD Connection Control
RF Generator Off
Int. (10 MHz)
Ext. (at REF IN)
10.0000 MHz
Reference Frequency
10.0000 MHz
REF OUT 1
Off / Oth. Net
On / Cur. Net
30.720 MHz
REF OUT 2
Analyzer
Generator
UE Code
RF
Sync.
1
2

Fig. 4-62 Connection Control – Sync.

Reference Frequency

The *Reference Frequency* softkey determines the source and the frequency of the reference signal.

The associated field permits to select between two alternatives:

Int. (10 MHz)	Internal synchronization with 10 MHz (TCXO or OCXO, CMU-B11/-B12) applied to output REF OUT 1 at the rear of the instrument.
Ext. (at REF IN)	External reference signal to be fed in via input *REF IN* and applied to output REF OUT 1 at the rear of the instrument.

The frequency of the external reference signal must be entered in the input field to the left of the *Ext. (at REF IN)* radio button.

The reference signal used is applied to output *REF OUT 1* so that it can be fed to other instruments as well. It can be used for synchronization to another instrument.

Notes:

1. *When external synchronization is selected, the header cyclically displays a warning Reference frequency not synchronized if the synchronization failed, e.g. because of a missing or faulty input signal. At the same time, bit no. 6 (RFNL, Reference Frequency Not Locked) is set in the STATus:OPERation:CMU:SUM1:CMU1 sub-register associated to the CMU base system.*
2. *In the case of external synchronization with squarewave signals (TTL) ensure correct signal matching to avoid reflections. Otherwise, resulting overshoots may cause trigger problems at the CMU input. A possible remedy is to use a lowpass filter or an attenuator pad directly at the CMU input. Correct synchronization may be checked by comparing the signal REF OUT 1 with the input signal.*
3. *This configuration is valid in all CMU function groups.*

Remote control
The commands for the reference frequency are part of the CMU base system (see CMU200/300 operating manual):

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE
              INTernal | EXTernal
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
```

REF OUT 2

The softkey *REF OUT 2* configures a network-specific system clock REF OUT 2 to be fed to the output REF OUT 2 at the rear of the instrument.

The associated field permits to select between two alternatives:

OFF (other network)	The clock frequency of the current function group is not fed to the output *REF OUT 2*. With this setting the system clock of another active function group (e.g. the network GSM1800 while the current function group) is still applied to *REF OUT 2* provided that the output *REF OUT 2* is switched on in the other function group. However, if *REF OUT 2* is explicitly switched over from *On* to *Off* the clock signal is definitely removed.
On (current network)	The network-specific system clock of the current function group is fed to output REF OUT 2. The system clock of any other function group applied to REF OUT 2 before is replaced.

Besides the basic clock frequency of 39 MHz one of the following clock frequencies may be selected:

0.960 0.991 1.024 1.059 1.097 1.138 1.181 1.229 1.335 1.396
1.463 1.536 1.617 1.706 1.807 1.920 2.028 2.194 2.363 2.560
2.793 3.072 3.143 3.840 4.388 5.120 6.144 7.680 10.240 15.360
30.720

(The values are calculated according to the formula F_{out} = *30.720 MHz / n* where *n = 1, ..., 31.*)

The clock frequency can be used to synchronize other instruments.

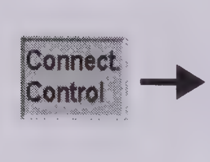
Remote control

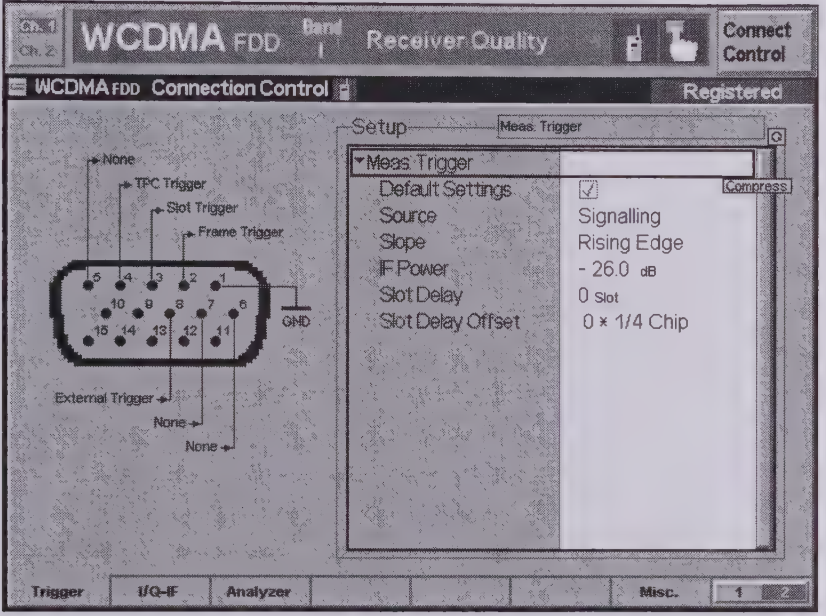
```
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

Trigger (Connection Control – Trigger)

The *Trigger* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2a* again switches back to the first group of tabs described above.

The *Trigger* tab defines the trigger settings for the measurement.


Connect Control


Ch. 1
Ch. 2
WCDMA FDD
Band I
Receiver Quality
Connect Control
WCDMA FDD Connection Control
Registered
None
TPC Trigger
Slot Trigger
Frame Trigger
5
4
3
2
1
10
9
8
7
6
15
14
13
12
11
GND
External Trigger
None
None
Compress
Trigger
I/Q-IF
Analyzer
Misc.
1
2

Setup: Meas. Trigger

Meas. Trigger	
Default Settings	☑
Source	Signalling
Slope	Rising Edge
IF Power	- 26.0 dB
Slot Delay	0 Slot
Slot Delay Offset	0 * 1/4 Chip

Fig. 4-63 Connection Control – Trigger

Trigger – Source

The *Source* parameter determines how the measurement is triggered:

Free Run	Trigger provided by analyzed RF signal: The CMU decodes the RF signal to derive its slot timing.
External	External trigger signal fed in via connector AUX 3 (pin 8)[3]. The required timing information is provided by the rising or falling edge (see *Slope* setting below) of an external trigger signal to which a trigger delay can be added. The beginning of the measured slot is searched in a symmetric time range of ±380 chips around the specified point, which is given by the trigger time plus the defined trigger delay (see *Fig. 4-65 below*). Compared to the *Free Run* mode, the search range is smaller so that the measurement is faster.
Internal	Trigger provided by internal RF generator (with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator*, only), according to the frame timing of the UL signal re-transmitted by the UE under test (frame trigger). The CMU assumes a delay of 1024 chip periods between the downlink and the uplink timing (3GPP standard timing offset). The beginning of the measured slot is searched as described for the *External* trigger (exception: *Inner Loop TPC* measurement; see section *Test Scenarios for Inner Loop TPC* on p. *4.3* ff.). Again, a trigger delay can be added to the frame trigger time (see *Fig. 4-65 below*). In addition to the frame trigger, a slot trigger signal at the beginning of each DL slot and a TPC trigger signal at the beginning of each TPC profile is provided.

---

[3] The external trigger signal at AUX 3 must be a high or low pulse with the following characteristics: Rise/fall time <20 ns; minimum high or low time ≥ 200 ns. The impedance of the trigger source must be ≤ 50 Ω.

The frame and slot trigger signals are always available while the RF generator is switched on. The TPC trigger is available while the generator transfers a TPC pattern. The trigger signals are also fed to pin 2 (frame trigger), pin 3 (slot trigger), and pin 4 (TPC trigger) of the AUX 3 connector at the front of the instrument where they can be tapped off to synchronize external devices. All trigger signals are low-pulse TTL signals with a length of ¼ slot (166 $^{2}/_{3}$ µs); see *Fig. 4-65 below.*

In the *Internal* trigger mode, the TPC trigger is used for the *Inner Loop TPC* measurement; see section *Test Scenarios for Inner Loop TPC* on p. *4.3* ff. The frame trigger is used for all other measurements. The slot trigger is for external use only.

IF Power The measurement is triggered by the level of the IF signal (rising or falling edge; see *Slope* setting below), the trigger level is specified via the *Level* parameters. Narrow-band IF power trigger.

Remote control
`TRIGger[:SEQuence]:SOURce FRUN | EXTern | INTern | IFPower`

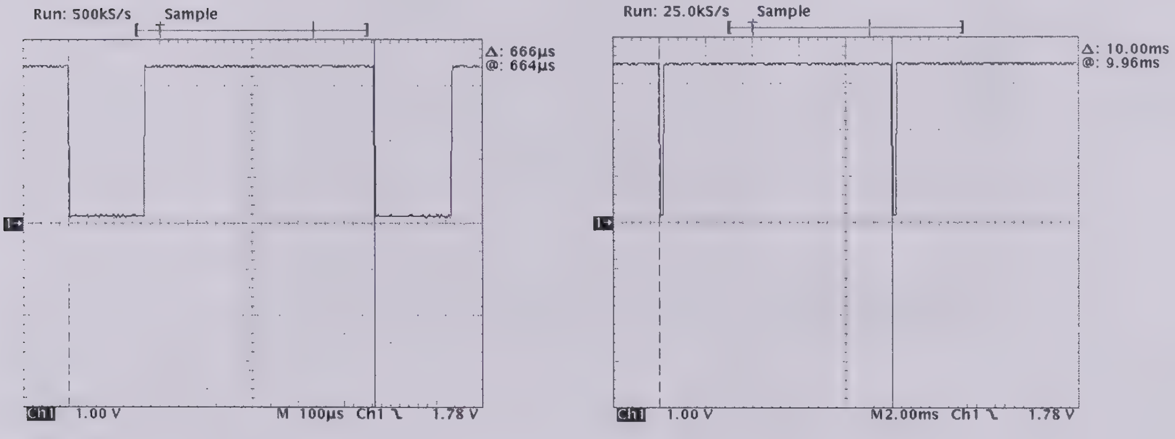


Fig. 4-64 Slot trigger and frame trigger

Trigger – Slot Delay The *Slot Delay* parameter defines a delay time (integer number of slots) between the trigger time and the start of the measurement. If a frame-periodic internal or external trigger signal is available, *Slot Delay* can be used to select any slot of the frame as measured slot. An additional *Delay Offset* can be added to the *Slot Delay;* see *Fig. 4-65 below.*

The *Slot Delay* parameter is ignored in *Free Run* measurements; see above.

Remote control
`TRIGger[:SEQuence]:DELay <Slot_Delay>, <Delay_Offset>`

Trigger – Delay Offset The *Delay Offset* parameter defines a delay time in multiples of ¼-chip periods between the trigger time (plus a *Slot Delay*, if defined) and the start of the measurement. In general a *Delay Offset* is used to compensate for an offset between the (external or internal) trigger time and the beginning of the uplink slot to be measured. This can be necessary for various reasons:

- If *Internal* trigger is set the CMU is triggered by the TPC trigger (application *Inner Loop TPC)* or by the frame trigger of the internal DL generator (all other measurements). Compared to the internal trigger time, the UL signal from the UE is delayed by the standard RX/TX timing offset of 1024 chip periods. In order to coincide with the UL timing the internal trigger signal is also delayed by the nominal timing offset. No additional *Delay Offset* is required to compensate for the nominal timing offset.

- If *External* trigger is set, an appropriate *Delay Offset* compensates for a trigger timing error.
- In addition the *Delay Offset* can be used to correct a possible propagation delay in the signal path from the CMU to the UE and back.

The *Delay Offset* parameter is ignored in *Free Run* measurements; see above.

Remote control
`TRIGger[:SEQuence]:DELay <Slot_Delay>, <Delay_Offset>`

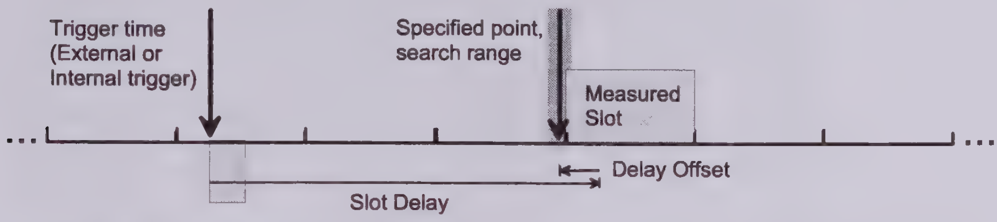


Fig. 4-65 Slot Delay and Delay Offset

IF Power

IF Power parameter defines the trigger threshold if the measurement is triggered by the *IF Power* (see *Source* function above). The trigger threshold is the IF trigger signal level beyond which the trigger condition is satisfied and a measurement is initiated. The threshold is defined relative to the maximum input level set in the *Analyzer* tab.

IF power trigger threshold = <RF Max. Level> + <IF Power>

Note: *The trigger levels are always relative to the* ***current*** *maximum input level. If RF Max. Level is set manually (RF Mode = Manual), the current input level is constant and equal to the setting value. In autoranging mode (RF Mode = Auto), the current maximum input level is dynamically adapted to the measured RF input level; the trigger levels change accordingly.*

Remote control
`TRIGger[:SEQuence]:THReshold:IFPower <Power>`

Slope

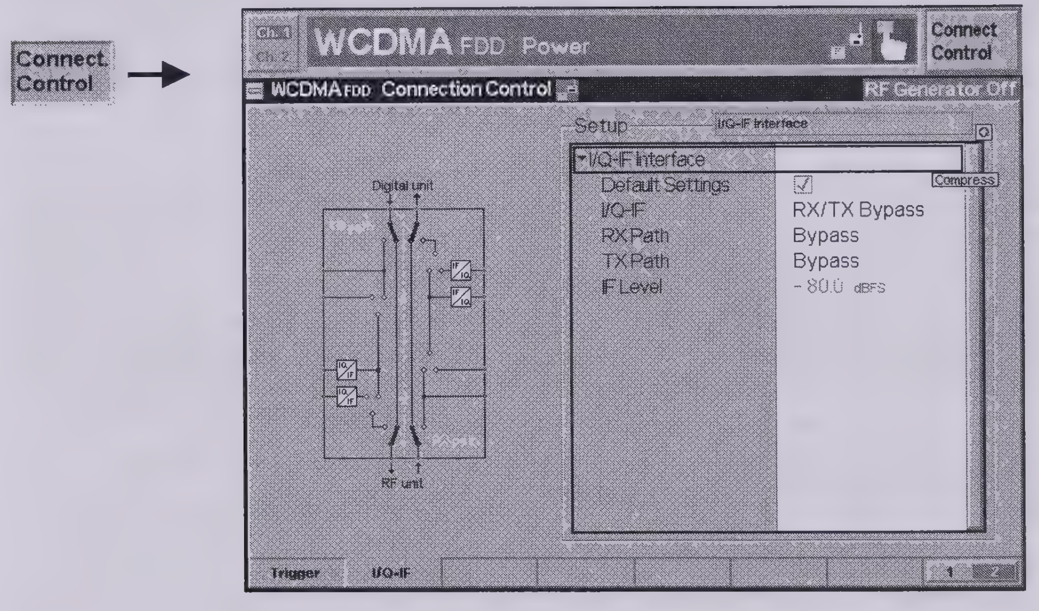
Slope qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements or *Internal* trigger source.

Remote control
`TRIGger[:SEQuence]:SLOPe POSitive | NEGative`

I/Q-IF Interface (Connection Control – I/Q-IF)

The *I/Q-IF* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2* again switches back to the first group of tabs described above.

The *I/Q-IF* tab configures the signal paths for I/Q and IF signals. With option CMU-B17, *I/Q and IF Interfaces,* I/Q and IF signals can be used in the framework of *RF* measurements and in many network tests. For a detailed description of rear panel connectors for I/Q and IF input/output signals, test scenarios and application examples refer to the CMU200/300 operating manual.



▾I/Q-IF Interface
Default Settings ☑
I/Q-IF RX/TX Bypass
RX Path Bypass
TX Path Bypass
IF Level - 80.0 dBFS

Fig. 4-66 Connection Control – I/Q-IF

Default Settings
The *Default Settings* checkbox assigns the default setting to all functions in the *I/Q-IF* tab.

Remote control
`IQIF:DEFault ON | OFF`

I/Q-IF
Selects the I/Q-IF test scenario, overwriting the current *RX Path* and *TX Path* settings. Six different predefined test scenarios with fixed RX and TX path are provided; see *Table 4-18 below.*

Additional scenarios may be defined by selecting any other combination of RX and TX paths. When this is done *I/Q-IF* is set to *User-defined.* The circuit diagram to the left of the *Setup* table shows the current RX and TX signal paths.

Remote control
```
CONFigure:IQIF:RXTXcombined
        BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF
```

RX Path
Selects the RX signal path, leaving the *TX Path* unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then *I/Q-IF* is set to the predefined scenario; otherwise it is set to *User-defined.*

The circuit diagram to the left of the *Setup* table shows the current RX and TX signal paths.

Remote control
```
CONFigure:IQIF:RXPath
        BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF
```

RX Path Selects the TX signal path, leaving the *RX Path* unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then *I/Q-IF* is set to the predefined scenario; otherwise it is set to *User-defined*.

The circuit diagram to the left of the *Setup* table shows the current RX and TX signal paths.

Remote control

```
CONFigure:IQIF:TXPath
        BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF
```

IF Level Indicates the IF output level in the TX path relative to the maximum IF input/output level (PEP) cited in the data sheet. The value is equal to the I/Q output level in the TX path relative to the maximum I/Q input voltage cited in the data sheet. The result is in dBFS units (dB Full Scale).

Remote control

```
[SENSe:]IQIF_IFLevel?
```

Table 4-18 I/Q-IF scenarios and path settings

I/Q-IF	**RX Path**	**TX Path**	**Remark/Application** (see also CMU manual)
RX/TX Bypass	Bypass	Bypass	No I/Q or IF inputs/outputs connected Direct signal analysis and transmission with full measurement accuracy
Byp. w. I/Q-OF OUT	Bypass w. I/Q-IF OUT	Bypass w. I/Q-IF OUT	No I/Q or IF inputs connected Analysis of received and transmitted signal via I/Q or IF
I/Q IN/OUT	I/Q IN/OUT	I/Q IN/OUT	Insertion of signal to be analyzed and transmitted on I/Q level
IF IN_I/Q IN/OUT	IF IN_I/Q IN/OUT	IF IN_I/Q IN/OUT	Additional processing of received and transmitted signal on IF level (filters etc.) and analysis via I/Q
IF IN/OUT	IF IN/OUT	IF IN/OUT	Insertion of signal to be analyzed and transmitted on IF level
Fading	Bypass	I/Q IN/OUT	Direct analysis of received signal Modification (fading) of transmitted signal by means of an external fading simulator (SMIQ, ABFS)
User-defined	Any combination of RX Path and TX Path not listed above		Any combination of RX and TX test cases listed above

Measurements in Signalling Mode

The scope and functionality of the *Signalling* measurement applications is the same as in *Non Signalling* mode. In *Signalling* tests the CMU maintains a connection to the DUT and is able to transmit and receive signalling information and data, using the settings defined in the *Connection Control* menu, in particular the uplink and downlink signal settings from the *UE Signal* and *BS Signal* tabs. A typical example is given below.

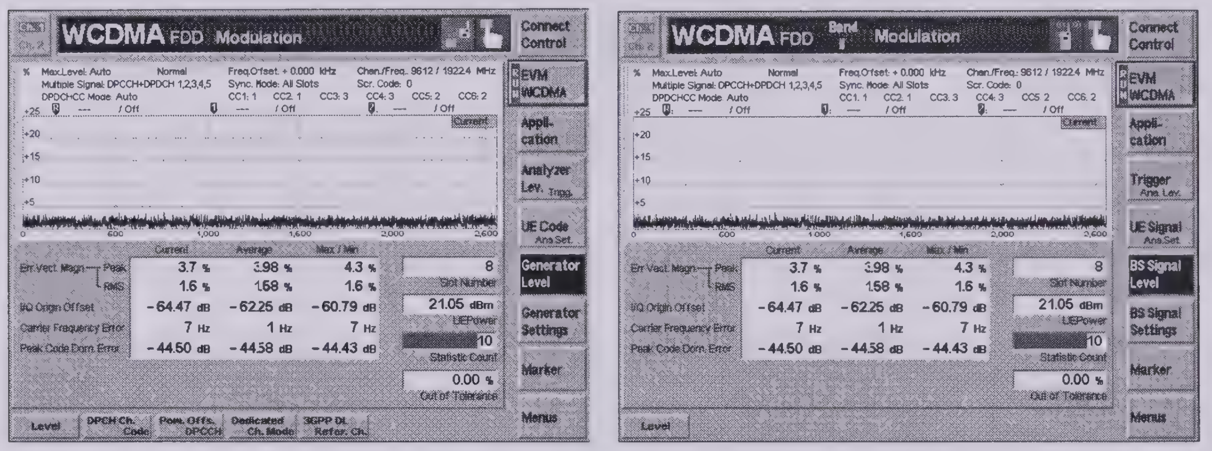

WCDMA FDD Modulation
Connect Control
EVM WCDMA
Appli- cation
Analyzer Lev. Trigg.
UE Code Ana.Set.
Generator Level
Generator Settings
Marker
Menus
Level
DPCH Ch. Code
Pow. Offs. DPCCH
Dedicated Ch. Mode
3GPP DL Refer. Ch.
Max.Level: Auto
Normal
Freq.Offset: + 0.000 kHz
Chan./Freq.: 9612 / 1922.4 MHz
Multiple Signal: DPCCH+DPDCH 1,2,3,4,5
Sync. Mode: All Slots
Scr. Code: 0
DPDCHCC Mode: Auto
Current
Average
Max / Min
Err.Vect. Magn. Peak
RMS
IQ Origin Offset
Carrier Frequency Error
Peak Code Dom. Error
Slot Number
UEPower
Statistic Count
Out of Tolerance
WCDMA FDD Band Modulation
Trigger Ana. Lev.
UE Signal Ana.Set.
BS Signal Level
BS Signal Settings

Fig. 4-67 Comparison of Non Signalling and Signalling measurement menu

The exchange of data in *Signalling* mode generally simplifies the measurements, because a connection can be set up, maintained or released using the default signal configuration and because there is no need to configure the CMU and the DUT separately.

All TX measurements *(Power, Modulation, Spectrum, Code Domain Power)* can be made irrespective of the *Dedicated Channel Type* (see p. 4.169) and the *Test Mode* (see p. 4.170). To perform a *Receiver Quality* measurement, an RMC connection must be set up and the UE must be in its *Loop mode 1 RLC TM* or *Loop mode 2.*

The table below gives an overview the measurement applications in *Signalling* mode and the differences between the two test modes. For a general overview of the measurement functionality in both test modes see Chapter 3, section *Measurement Groups.*

Table 4-19 Measurements in Signalling mode

Measurement	**Behavior in Signalling mode** **(if different from Non Signalling mode)**
Power:	
Max Power	–
Min Power	–
Off Power	–
Inner Loop TPC	No need to adjust the *TPC Mode* and the *Step Size* at the CMU: Both parameters are directly taken from signalling; see *Connection Control – BS Signal – TPC Settings*[4].

---

[4] The *Non Signalling* command CONFigure:POWer:ILTPc:CONTrol:TPCControl <ProfileLength>, <StepSize>, <TPCMode> is replaced by CONFigure:POWer:ILTPc:CONTrol:PLENgth <ProfileLength> in *Signalling;* see remote control documentation.

Measurement	**Behavior in Signalling mode (if different from Non Signalling mode)**
Modulation:	
Overview QPSK EVM QPSK Phase Error QPSK Magn. Error QPSK	– – – –
Overview WCDMA EVM WCDMA Phase Error WCDMA Magn. Error WCDMA	No need to set the *UE Code* parameters *Multiple Signal* and *Sym. Rate/Chan. Code*. The parameters are implicitly included in the dedicated channel settings. The *UL Scrambling Code* that the UE shall use can be set in the *UE Signal* tab and doesn't have to be configured at the UE.
Spectrum	
ACLR Filter ACLR FFT/OBW Emission Mask	– – –
Code Domain Power[5]	
CDP/Code Auto CDP/Code Rho Auto CDP/Code Manual CDP/Code Rho Manual	No need to set the *UE Code* parameters *Multiple Signal, Sym. Rate/Chan. Code, DPDCH Sym. Rate*. The parameters are implicitly included in the dedicated channel settings. The *UL Scrambling Code* that the UE shall use can be set in the *UE Signal* tab and doesn't have to be configured at the UE.
Receiver Quality	
BER	*Connection Info* displayed in the *Settings* table in the measurement menu. No need to set the *DL/UL Timing* parameter: UE is synchronized to the BS Signal when a connection is established. *Uplink CRC* in the *BS Signal* tab *(see p.* 4.170*)* replaces the *DL/UL Transport Block Size* in the *Receiver Quality Configuration* menu: *Uplink CRC = Off* sets an asymmetric UL/DL transport block size and enables the BLER measurement. In addition, it is possible to perform *Receiver Quality* tests with different RMCs in the downlink and the uplink. CMU checks whether the *Loop Mode 1 or 2* is active. If this is not true an error message is generated. ***Note:*** *To make a Receiver Quality measurement in* Signalling *mode it is sufficient to set the following parameters:* ➢ *Select a RMC as Dedicated Channel Type (see p.* 4.169*) and set the Test Mode (see p.* 4.170*) to either Loop Mode 1 RLC TM or Loop Mode 2.* ➢ *To enable the BLER measurement, select Uplink CRC = Off (see p.* 4.170*).* *If desired, change the Channel Data Source DTCH (p.* 4.171*) or modify other signal settings.*
UE Report	Not available in *Non Signalling* mode.

Important hints concerning the Signalling measurements:

Modulation

The **QPSK** applications in the *Modulation* measurement group provide a fast analysis of signals with undisturbed QPSK modulation characteristics (e.g. a single DPCCH, a single DPDCH, or a combination of a DPCCH with one DPDCH). The measurement requires an uplink signal with **equal gain factors** in its I and Q component. The gain factors can be adjusted by the UTRAN/CMU. They are equal if the *Dedicated Channel Type* (see p. 4.169) is set to *SRAB*.

Note: *The standard 3GPP Reference Measurement Channels* (Dedicated

---

[5] In *Non Signalling* mode the *Code Domain Power* measurement is based on the *UE Code* settings from the *Connection Control* menu. In *Signalling* mode the UE code settings are taken from the 3.4 kbps radio bearer used to establish and maintain the connection between the CMU and the UE under test.

Channel Type = RMC) *are specified with unequal gain factors for the DPCCH and DPDCH, so the QPSK modulation analysis on RMCs is bound to fail and the* Modulation ... WCDMA *applications must be used.*

Spectrum The *Spectrum* measurement provides the RF spectrum emissions in the frequency domain. While measuring on off-channel frequencies the CMU may not be able to receive signalling data from the UE. This does not affect the measurement results but can cause the analyzer to temporarily ignore actions initiated from the DUT.

Connnection Control (Signalling)

The menu group *Connection Control* controls the communication between the CMU and the UE (connection setup and release, UE and BS signals, network parameters), configures the inputs and outputs with the external attenuation values and the reference frequency, and defines the trigger settings.

The term signalling denotes all procedures that are necessary for setup, control and release of a connection in the UTRAN. In the case of WCDMA UE tests, a distinction is made between five different signalling states:

Signal Off	CMU transmits no signal; no connection to the UE is possible
Signal On	CMU emulates a UTRAN cell, transmitting a WCDMA signal *(BS Signal)* to which a UE can synchronize. After synchronization the UE can initiate a registration towards the CMU, and the CMU can page the UE in order to attempt a connection.
Registered	Synchronization with the UE and registration performed
Alerting	CMU is attempting a connection to the UE; UE is responding (ringing) but connection not yet accepted at the CMU. This state is optional and can be skipped using the *Dedicated Channel Type = RMC* and *Test Mode = ON* or *Test Mode = Loop Mode 1 RLC TM/Loop Mode 2* settings; see *Fig. 4-69* on p. 4.144.
Connected	RRC connection between CMU and UE established. This means that dedicated channels are allocated between the CMU/UTRAN and the UE. Depending on the Radio Access Bearer (RAB) configuration, the dedicated channel can consist of the Signalling Radio Bearer (SRB) used to set up the connection or other RABs, e.g. a Reference Measurement Channel (RMC) or voice channel (AMR).

A number of control commands which can be initiated both by the CMU *(Call to UE, UE Terminating Call)* and by the UE *(Call from UE, UE Originated Call)* switch between these states (the dashed lines in *Fig. 4-68* denote processes initiated by the UE).

Many applications within the function group *WCDMA UE Signalling (3GPP/FDD)* are only possible or useful in particular signalling states. (For example, the parameters describing the *UE Radio Access Capability*, displayed in a table in the left half of the *Connection* tabs, are provided by the UE after registration or after a connection is established. They are not available in the *Signal Off* and *Signal On* states.) This implies that the functionality of menus may vary depending on the signalling state. For reference see the *Sig. State* field in the command tables in Chapter 6.

The purpose of the *Signalling* test mode is to perform transmitter and receiver tests with an existing call (or data transfer) connection between the CMU and the UE. Therefore the menus for setting up a connection (*Connection Control – Connection)* appear immediately after the function group and mode *WCDMA UE Signalling (3GPP/FDD)* is activated. Besides, all the tabs in the *Connection Control* menu can be called up by pressing the *Connect. Control* softkey at the top right in every measurement menu. They are linked with each other via the hotkey bar at the lower edge of the screen. Pressing the *Escape* key closes the active *Connection Control* menu and re-activates the underlying measurement menu.

The signalling state machine of the CMU depends on the *Dedicated Channel Type* (see p. 4.169) and *Test Mode* (see p. 4.170) settings. In all settings except *Dedicated Channel Type = RMS* and *Test Mode*

= *ON* or *Test Mode* = *Loop Mode 1 RLC TM/Loop Mode 2,* a connection initiated from the CMU is set up via the *Alerting* state. Alternatively the connection can be initiated from the UE:

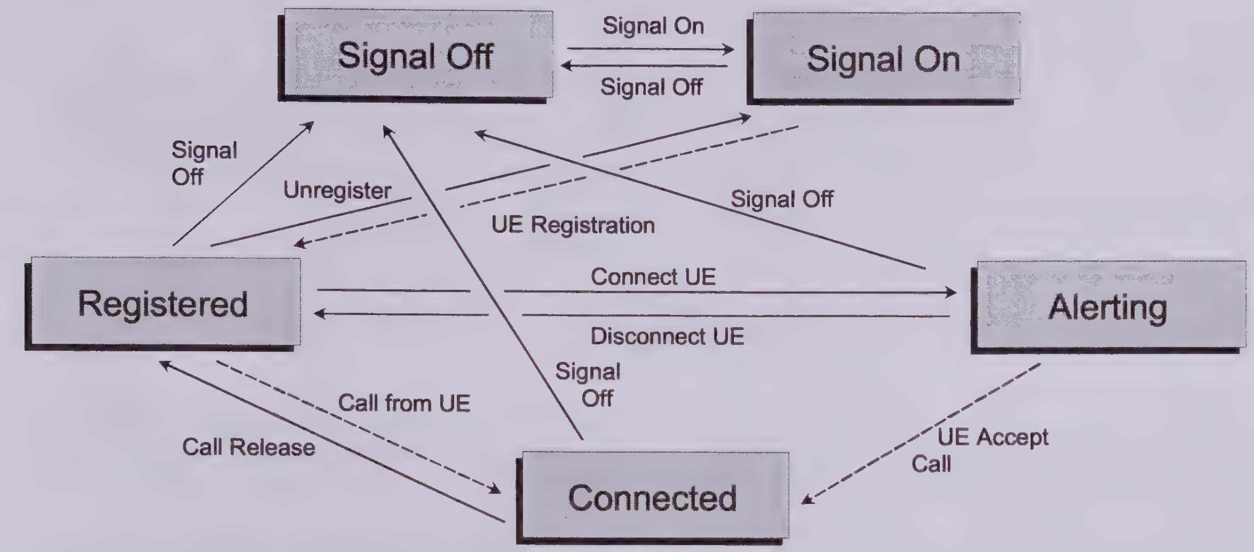

Signal Off
Signal On
Signal On
Signal Off
Signal Off
Unregister
UE Registration
Signal Off
Registered
Connect UE
Disconnect UE
Alerting
Signal Off
Call from UE
Call Release
UE Accept Call
Connected

Fig. 4-68 Signalling states of the CMU: Connection with Alerting

If *Dedicated Channel Type* = *RMC* and *Test Mode* = *ON* or *Test Mode* = *Loop Mode 1 RLC TM/Loop Mode 2,* the *Alerting* state is skipped if the CMU initiates the connection, and no call from the UE is possible:

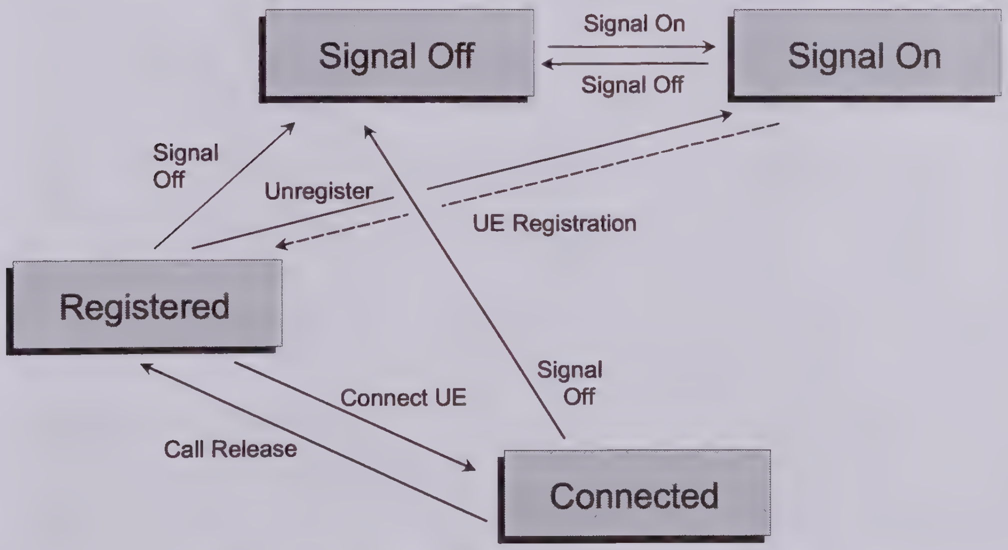

Signal Off
Signal On
Signal On
Signal Off
Signal Off
Unregister
UE Registration
Registered
Signal Off
Connect UE
Call Release
Connected

Fig. 4-69 Signalling states of the CMU: Connection without Alerting

Corresponding to the five possible signalling states, five different *Connection* tabs are available. When one of the signalling states *Signal Off, Signal On, Registered* or *Alerting* is reached, the corresponding tab is opened automatically. On the other hand the *Connected* tab is closed immediately after the CMU reaches the *Connected* state so that a measurement can be started. To change this behavior the *Connect. Control Guidance* parameter is provided; see section *Display Control (Connection Control – Misc)* on p. 4.183 ff.

Note: Paging State

The CMU displays a message “Paging in progress “ while it attempts to establish a connection and before it enters the Alerting *or* Connected *state. In remote control,* Paging *is a separate transitory signalling state, to be queried with the* `FETCh:SIGNalling:STATus?` *command.*

Note: Circuit switched and packet switched services

The UMTS core network consists of two service domains, the circuit switched (CS) and the packet switched (PS) domain. A UE that supports both CS and PS services can be connected to one of the service domains or to both domains. The connection schemes for both domains are independent from each other.

The connection scheme described in this section is valid for CS services.

Note: General recommendation for speeding up Signalling tests:

Refer to Chapter 2, section Accelerating the Connection.

Connection – State Signal Off

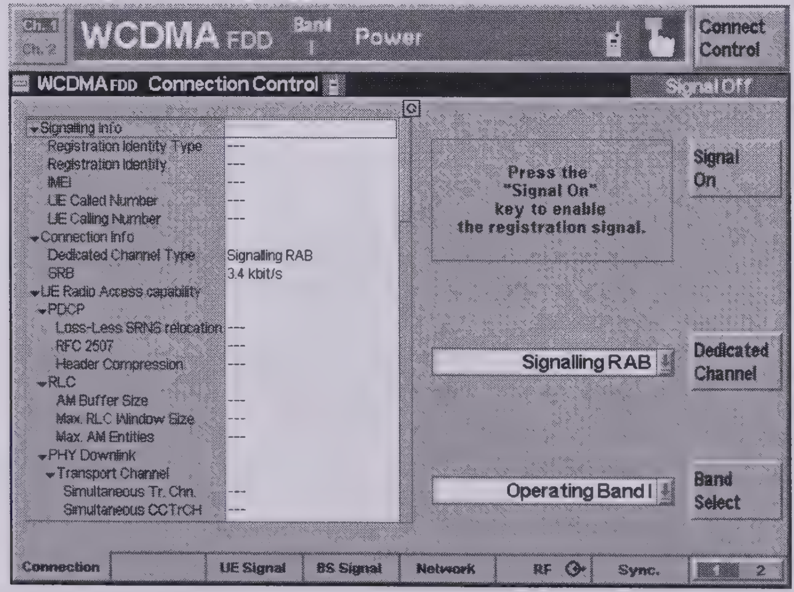
The *Connection (Signal Off)* tab provides a list of parameters describing the capabilities of the UE. Besides, the tab contains softkeys which lead to other operating modes or signalling states:

- Select the *Dedicated Channel* to be allocated between the CMU/UTRAN and the UE.
- Set up a UTRAN cell; activate the WCDMA signal *(BS Signal)* to which the UE can synchronize *(Signal On)*

The CMU provides a second version of the *Connection* tab where the info table on the left side is replaced by softkeys. The softkeys provide RF channel and power settings and control the *Openloop Power* measurement; see section *Connection – RF Channel and Power* on p. 4.155 ff. The *Connection* hotkey toggles between the two versions of the tab if it is pressed repeatedly.

The tab *Connection (Signal Off)* is opened when the function group *WCDMA UE Signalling (3GPP/FDD)* is selected, or if the WCDMA signal is switched off *(Signal Off* softkey*)* while the system is in another signalling state. It is replaced by the *Connection (Signal On)* tab after the WCDMA signal *(BS Signal)* of the CMU is switched on so that the CMU emulates a UTRAN cell (softkey *Signal On, Fig. 4-68*).

Connect Control →



Signalling Info	
Registration Identity Type	---
Registration Identity	---
IMEI	---
UE Called Number	---
UE Calling Number	---
Connection Info	
Dedicated Channel Type	Signalling RAB
SRB	3.4 kbit/s
UE Radio Access capability	
PDCP	
Loss-Less SRNS relocation	---
RFC 2507	---
Header Compression	---
RLC	
AM Buffer Size	---
Max. RLC Window Size	---
Max. AM Entities	---
PHY Downlink	
Transport Channel	
Simultaneous Tr. Chn.	---
Simultaneous CCTrCH	---

Press the "Signal On" key to enable the registration signal.

Signalling RAB

Operating Band I

Fig. 4-70 Connection Control – Connection (Signal Off)

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.150 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("—").

Message Box A message box (here: *Press the Signal On key to enable the synchronization signal)* in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signal On

The *Signal On* softkey switches on a WCDMA signal *(BS Signal)* to which the UE can synchronize. By switching on the signal, the CMU changes to the signalling state *Signal On*. A user prompt below the header indicates the function of this softkey.

Remote control
`PROCedure:SIGNalling:ACTion SON`

Dedicated Channel

The *Dedicated Channel* softkey selects the dedicated channel to be allocated between the CMU/UTRAN and the UE.

Signalling RAB	The CMU uses a Signalling Radio Bearer (SRB) of variable data rate to establish and maintain the connection; see background information in section *Connnection Control (Signalling)* on p. 4.143 ff.
RMC	The CMU uses a fixed 2.5 kbps Signalling Radio Bearer (SRB) plus a Reference Measurement Channel.
Voice	The CMU uses a fixed 3.4 kbps Signalling Radio Bearer (SRB) plus a voice (AMR) channel.

The Dedicated Channels can be configured in the *BS Signal* tab; see *Dedicated Channel Type* (see p. 4.169) and *Test Mode* (see p. 4.170) settings. In particular, with *Dedicated Channel = RMS,* it is possible to command the UE to a test loop mode.

Remote control
`CONFigure:BSSignal:DCH:TYPE  RMC | VOIC | SRAB`

Band Select

The *Band Select* softkey selects the UTRA/FDD frequency band in which the UE is designed to operate:

- Operating Band I comprises uplink frequencies between 1920 MHz and 1980 MHz, and downlink frequencies between 2110 MHz and 2170 MHz. Operating Band I requires option R&S CMU-K68.
- Operating Band II comprises uplink frequencies between 1850 MHz and 1910 MHz, and downlink frequencies between 1930 MHz and 1990 MHz. Operating Band I requires option R&S CMU-K69.
- Operating Band III comprises uplink frequencies between 1710 MHz and 1785 MHz, and downlink frequencies between 1805 MHz and 1885 MHz. Operating Band I requires option R&S CMU-K67.

All uplink and downlink channel numbers and frequencies are quoted in *Table 4-6* on p. 4.107 and in *Table 4-10* on p. 4.117, respectively.

Remote control
`CONFigure:NETWork:OBANd OPB1 | OPB2 | OPB3`

Connection – State Signal On

In addition to the parameter overview and the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.145 ff., the *Connection (Signal On)* tab contains the following softkeys which lead to other signalling states:

- Switch off the WCDMA signal *(BS Signal)* for synchronization *(Signal Off)*

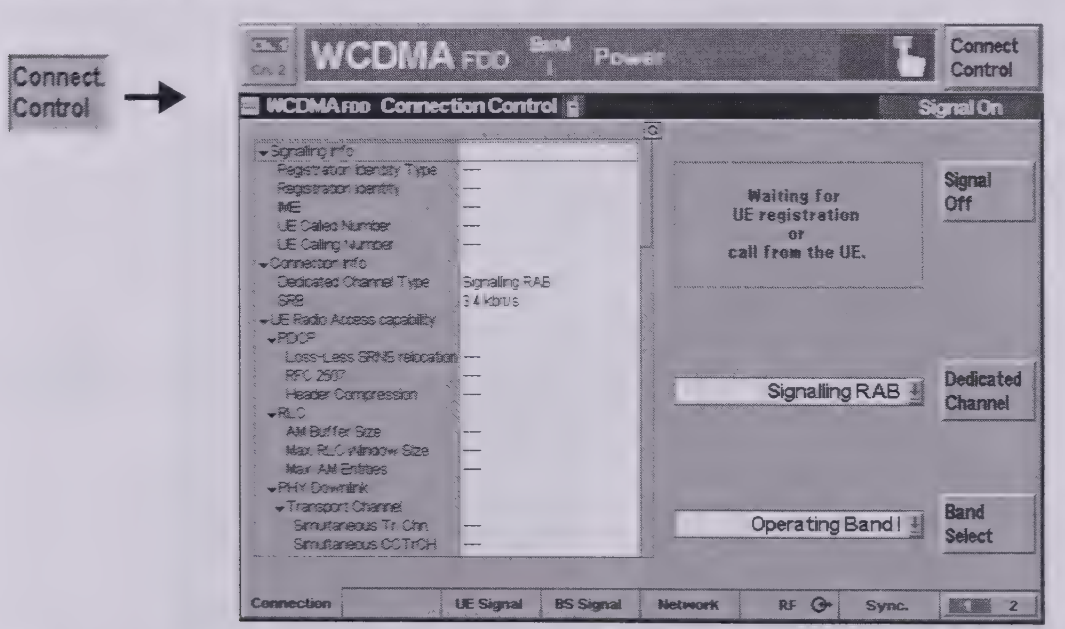
Downlink WCDMA signal

The downlink WCDMA signal that the CMU transmits in the *Signal On* state has all the properties that are necessary to mimic a UTRAN cell, allowing the UE to synchronize, to initiate a registration/location update towards the network, and to set up a RRC connection. The WCDMA signal has the following channel contributions:

- The synchronization channels P-CPICH, P-SCH and S-SCH
- The broadcast channels P-CCPCH, S-CCPCH, PICH, AICH
- The dedicated physical channel DPCH (DPDCH, DPCCH)

The power of all channels can be changed individually in the *BS Signal* tab; see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.167 ff.

The tab Connection *(Signal On)* is opened after the WCDMA signal *(BS Signal)* of the CMU is switched on so that the CMU emulates a UTRAN cell (softkey *Signal On* in the tab Connection *(Signal On))* or if the CMU forces a previously registered UE to initiate a new registration (softkey *Unregister* in the tab Connection *(Registered))*. It is replaced by the *Connection (Registered)* tab after the UE initiates a registration (see *Fig. 4-68*).



▾Signaling Info	
Registration Identity Type	—
Registration Identity	—
IMEI	—
UE Called Number	—
UE Calling Number	—
▾Connection Info	
Dedicated Channel Type	Signalling RAB
SRB	3.4 kbit/s
▾UE Radio Access capability	
▾PDCP	
Loss-Less SRNS relocation	—
RFC 2507	—
Header Compression	—
▾RLC	
AM Buffer Size	—
Max. RLC Window Size	—
Max. AM Entities	—
▾PHY Downlink	
▾Transport Channel	
Simultaneous Tr. Chn	—
Simultaneous CCTrCH	—

Waiting for
UE registration
or
call from the UE.

Signalling RAB

Operating Band I

Fig. 4-71 Connection Control – Connection (Signal On)

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.150 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("—").

Message box A message box (here: *Waiting for UE synchronization or call from the UE)* in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Signal Off

The *Signal Off* softkey switches off the CMU's WCDMA cell signal *(BS Signal)* so that synchronization of the UE is lost. The CMU changes to the signalling state *Signal Off*.

Remote control
`PROCedure:SIGNalling:ACTion SOFF`

Connection – State Registered

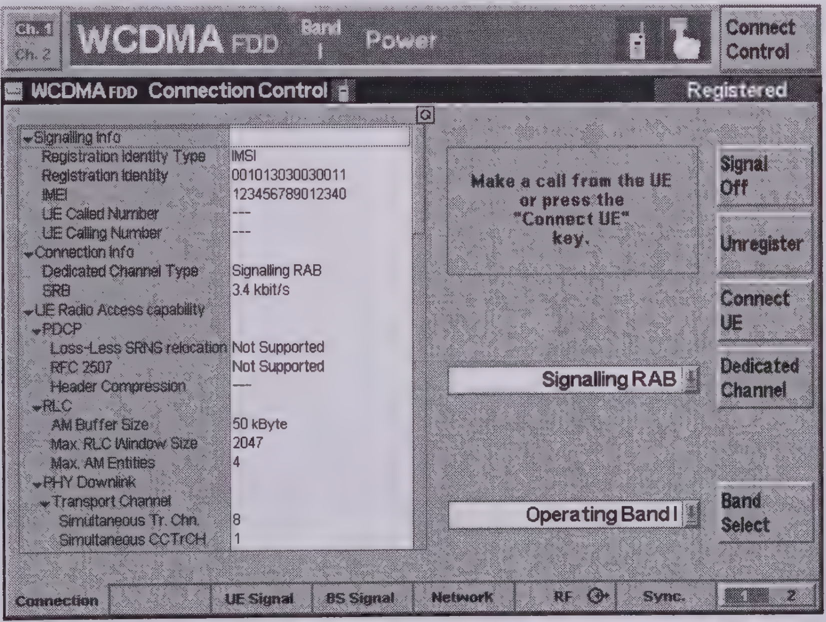
In addition to the parameter overview and the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.145 ff., the *Connection (Registered)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the WCDMA signal *(BS Signal)* for synchronization *(Signal Off)*
- Return to the *Signal On* state where the UE can attempt a new registration *(Unregister* -> return to state *Signal On)*
- Establishing a connection to the UE (*Connect UE* -> state *Alerting)*

The tab Connection *(Registered)* is opened when a successful RRC connection (in which case a registration/location update is considered as being already performed) is released *(Disconnect UE* softkey in the *Alerting* or in the *Connected* state, UE connection release, loss of radio link) or when a registration is initiated by the UE. It is replaced by the *Connection (Alerting)* tab if the CMU initiates a connection to the UE (softkey *Connect UE)*, or by the *Connection (Connected)* tab if the UE initiates a connection to the CMU, see *Fig. 4-68* on page 4.144.

Note: *The parameter settings in the Requested UE Data section of the Network tab have and influence on the registration procedure; see p. 4.179. If registration fails, check whether the UE capabilities are in accordance with the Requested UE Data settings.*

Connect Control →



Signalling Info	
Registration Identity Type	IMSI
Registration Identity	001013030030011
IMEI	123456789012340
UE Called Number	---
UE Calling Number	---
Connection Info	
Dedicated Channel Type	Signalling RAB
SRB	3.4 kbit/s
UE Radio Access capability	
PDCP	
Loss-Less SRNS relocation	Not Supported
RFC 2507	Not Supported
Header Compression	---
RLC	
AM Buffer Size	50 kByte
Max. RLC Window Size	2047
Max. AM Entities	4
PHY Downlink	
Transport Channel	
Simultaneous Tr. Chn.	8
Simultaneous CCTrCH	1

Make a call from the UE or press the "Connect UE" key.

Signalling RAB

Operating Band I

Fig. 4-72 Connection Control – Connection (Registered)

The softkey *Signal Off* is described in section *Connection – State Signal On* on page 4.147.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.150 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("---").

Message box A message box (here: *Make a call from the UE or press the "Connect UE" key)* in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Unregister The softkey *Unregister* resets the CMU to the *Signal On* state where the UE can attempt a new registration or a connection. This feature can be useful if the UE is replaced without switching the WCDMA signal *(BS signal)* off.

Remote control
`PROCedure:SIGNalling:ACTion UNR`

Connect UE The softkey *Connect UE* initiates a connection between the CMU and the UE. The CMU pages the UE and reaches the signalling state *Alerting* while the UE starts ringing. As soon as the connection is accepted at the UE the CMU changes to the signalling state *Connected.*

Remote control
`PROCedure:SIGNalling:ACTion CTM`

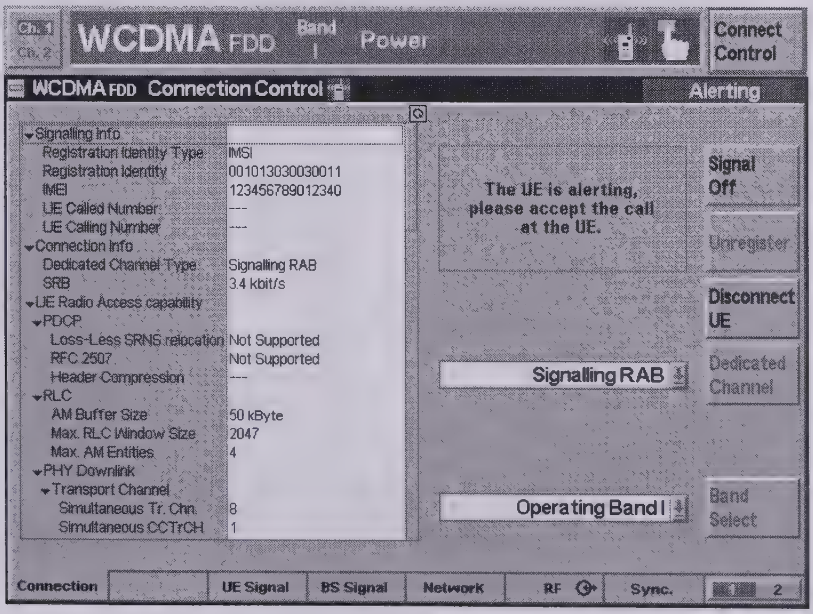
Connection – State Alerting

In addition to the parameter overview and the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.145 ff., the *Connection (Alerting)* tab contains the following softkeys which lead to other signalling states:

- Deactivation of the WCDMA signal *(BS Signal)* for synchronization and connection release *(Signal Off)*
- *Disconnect UE* while keeping the WCDMA signal *(BS Signal)* switched on (–> *Registered)*

The tab Connection *(Alerting)* is opened while the UE is ringing during a connection setup *(Connect UE* softkey in the *Signal On* or in the *Registered* state). It is replaced by the *Connection (Connected)* tab when the UE accepts the connection (is picked up), or by the *Connection (Registered)* tab if the connection is released *(Disconnect UE* softkey, UE connection release), see *Fig. 4-68.*

Connect Control →



Signalling Info	
Registration Identity Type	IMSI
Registration Identity	001013030030011
IMEI	123456789012340
UE Called Number	---
UE Calling Number	---
Connection Info	
Dedicated Channel Type	Signalling RAB
SRB	3.4 kbit/s
UE Radio Access capability	
PDCP	
Loss-Less SRNS relocation	Not Supported
RFC 2507	Not Supported
Header Compression	---
RLC	
AM Buffer Size	50 kByte
Max. RLC Window Size	2047
Max. AM Entities	4
PHY Downlink	
Transport Channel	
Simultaneous Tr. Chn.	8
Simultaneous CCTrCH	1

The UE is alerting, please accept the call at the UE.

Signalling RAB

Operating Band I

Fig. 4-73 Connection Control – Connection (Alerting)

The softkey *Signal Off* is described in section *Connection – State Signal On* on page 4.147.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs and is described in section *Connection – State Connected* on p. 4.150 ff. Some parameters are not always available, depending on the current and previous signalling states and settings. In this case the table shows invalid or unavailable settings ("—").

Message box A message box in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

Disconnect UE The *Disconnect UE* softkey releases the connection to the UE. The CMU changes to the signalling state *Registered.*

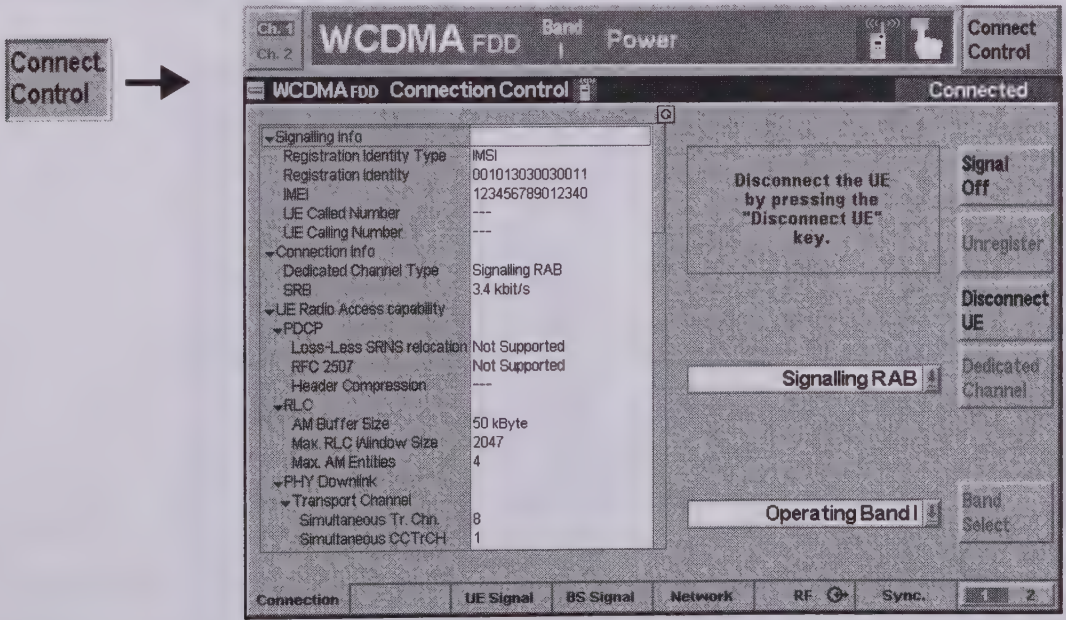
Remote control
`PROCedure:SIGNalling[CSWitched]:ACTion CREL`

Connection – State Connected

In its left half the *Connection (Connected)* tab displays a list of signalling parameters describing the capabilities of the UE. The right half contains, in addition to the *Dedicated Channel, Domain Type* and *Band Select* softkeys described in section *Connection – State Signal Off* on p. 4.145 ff., the following softkeys which lead to other signalling states:

- Deactivation of the signal for synchronization and release of the connection to the UE *(Signal Off)*
- Release of the connection to UE (*Disconnect UE* –> state *Registered)*

The tab Connection *(Connected)* can be opened after a connection attempt from the CMU *(Connect UE* softkey in the *Signal On* or in the *Registered* state) is accepted at the UE or after a successful connection attempt from the UE. It is replaced by the *Connection (Registered)* tab if the connection is released *(Disconnect UE* softkey, UE connection release) see *Fig. 4-68.*



Signalling info	
Registration Identity Type	IMSI
Registration Identity	001013030030011
IMEI	123456789012340
UE Called Number	---
UE Calling Number	---
Connection Info	
Dedicated Channel Type	Signalling RAB
SRB	3.4 kbit/s
UE Radio Access capability	
PDCP	
Loss-Less SRNS relocation	Not Supported
RFC 2507	Not Supported
Header Compression	---
RLC	
AM Buffer Size	50 kByte
Max. RLC Window Size	2047
Max. AM Entities	4
PHY Downlink	
Transport Channel	
Simultaneous Tr. Chn.	8
Simultaneous CCTrCH	1

Disconnect the UE by pressing the "Disconnect UE" key.

Fig. 4-74 Connection Control – Connection (Connected)

The function of the *Signal Off* softkey is described in section *Connection – State Signal Off* on page 4.145, the *Disconnect UE* softkey in section *Connection – State Alerting* on page 4.149.

Message box A message box in the right half of each *Connection* tab informs on the current instrument state or indicates how to proceed to get to other signalling states.

The parameter overview in the left half of the menu is also indicated in the other *Connection* tabs. In the *Connected* signalling state, all parameters are available, provided that the UE returns a valid result.

Signalling Info The *Signalling Info* parameter group contains information about UE and Node B identification.

Registration Identity Type	Type of Mobile Identity: IMSI, IMEI, IMSISV, TMSI, P-TMSI or None. This information is transferred during registration.
Registration Identity	Code number identifying the UE, depending on the *Identity Type*. This information is transferred during registration.
IMEI	International Mobile station Equipment Identity of the UE. The IMEI transferred during registration if the request is enabled in the *Network* tab; see p. 4.179.

The following information is available in the *Connected* state:

UE Called Number	Number dialed at the UE attempt a connection to the CMU
UE Calling Number	Number dialed at the CMU to attempt a connection to the UE

Remote control

```
[SENSe]:SIGNalling:RIType?
[SENSe]:SIGNalling:RIDentity?
[SENSe]:SIGNalling:IMEI?
[SENSe]:SIGNalling:DNUMber?
[SENSe]:SIGNalling:CNUMber?
```

Connection Info The *Connection Info* parameter displays the settings made to set up the connection.

Dedicated Channel Type	Dedicated channel (to be) allocated between the CMU/UTRAN and the UE; see p. 4.169.
SRB	Data rate of the Signalling Radio Bearer used, depending on the dedicated channel type.

Remote control

```
CONFigure:BSSignal:DCH:TYPE
CONFigure:BSSignal:DCH:RMC:RTYPE
```

The following parameters characterize the Radio Access Capability of the UE. They are described in standard TS 25.306 and the references given therein. The Radio Access Capability information is transferred during registration if the request is enabled in the *Network* tab; see p. 4.179.

PDCP

The *PDCP* section indicates in which way the UE supports the Packet Data Convergence Protocol described in standard TS 25.323:

Loss-less SRNS relocation	Support of loss-less SRMS relocation
RFC 2507	Support of header compression according to RFC 2507
Header Compression	Maximum header compression context size supported by the UE. This parameter is only applicable if the UE supports header compression according to RFC 2507.

Remote control
`[SENSe]:UECapability:PDCP?`

RLC

The *RLC* section indicates in which way the UE supports Radio Link Control Acknowledged Mode (RLC AM):

AM Buffer Size	Maximum total buffer size across all RLC AM entities supported by the UE
Max. RLC Window Size	Maximum RLC window size supported by the UE
Max. AM Entities	Maximum number of AM entities supported by the UE

Remote control
`[SENSe]:UECapability:RLC?`

Physical Downlink – Transport Channel

The *Physical Downlink – Transport Channel* section describes the capacity of the UE to simultaneously process and store downlink transport channels:

Simultaneous Tr. Chn.	Maximum number of downlink transport channels that the UE is capable to process simultaneously, not taking into account the rate of each transport channel.
Simultaneous CCTrCH	Maximum number of downlink Coded Composite Transport Channels (CCTrCHs) that the UE is capable to process simultaneously. CCTrCH should be interpreted as consisting of DCH, FACH or DSCH.
TTI Transport Blocks	Maximum total number of transport blocks received within Transmission Time Intervals (TTIs) that end within the same 10 ms interval. This includes all transport blocks that are to be simultaneously received by the UE on DCH, FACH, PCH and DSCH transport channels.
Number of TFC	Maximum number of Transport Format Combinations (TFC) in a downlink transport format combination set that the UE can store.
Number of TF	Maximum number of downlink Transport Formats (TF) that the UE can store, where all transport formats for all downlink transport channels are counted.
Turbo Decoding	Support for turbo decoding
Received Bits (Tr. Blocks)	Maximum number of bits of all transport blocks being received at an arbitrary time instant. This section comprises three values, corresponding to bits that are *Convolutionally Coded,* bits that are *Turbo Coded* and the sum of *All* bits.

Remote control
`[SENSe]:UECapability:PDOWnlink?`

Physical Downlink – Physical Channel FDD

The *Physical Downlink – Physical Channel FDD* section describes the capacity of the UE to process and store downlink physical channels:

DPCH/PDSCH Codes	Maximum number of DPCH/PDSCH codes to be simultaneously received. For DPCH in soft/softer handover, each DPCH is only calculated once. The capability does not include codes used for S-CCPCH.
Physical Channel Bits	Maximum number of physical channel bits received in any 10 ms interval (DPCH, PDSCH, S-CCPCH). For DPCH in soft/softer handover, each DPCH is only calculated once.
SF 512	Support for Spreading Factor (SF) 512 in downlink.
PDSCH	Support of the Physical Downlink Shared Channel (PDSCH).
Channel Estimation Pilots	Support for dedicated pilots for channel estimation.
Simultaneous Reception	Support of simultaneous reception of the Secondary Common Control Physical Channel and the Dedicated Physical Channel *(SCCPCH, DPCH)* and of the three channels *SCCPCH, DPCH, PDSCH*. The PDSCH part of the latter capability is only relevant if the UE supports PDSCH, as covered by the capability *PDSCH*.
SCCPCH Radio Links	Maximum number of radio links on which the UE is capable of receiving SCCPCH simultaneously.

Remote control
`[SENSe]:UECapability:PDOWnlink?`

Physical Uplink – Transport Channel

The *Physical Uplink – Transport Channel* section describes the capacity of the UE to simultaneously process and store uplink transport channels:

Simultaneous Tr. Chn.	Maximum number of uplink transport channels that the UE is capable to process simultaneously, not taking into account the rate of each transport channel.
Simultaneous CCTrCH	Maximum number of uplink Coded Composite Transport Channels (CCTrCHs) that the UE is capable to process simultaneously. This feature is relevant in FDD mode only.
TTI Transport Blocks	Maximum total number of transport blocks transmitted within Transmission Time Intervals (TTIs) that start at the same time.
Number of TFC	Maximum number of Transport Format Combinations (TFC) in an uplink transport format combination set that the UE can store.
Number of TF	Maximum number of uplink Transport Formats (TF) that the UE can store, where all transport formats for all uplink transport channels are counted.
Turbo Decoding	Support for turbo decoding
Transmitted Bits (Tr. Blocks)	Maximum number of bits of all transport blocks being transmitted at an arbitrary time instant. This section comprises three values, corresponding to bits that are *Convolutionally Coded,* bits that are *Turbo Coded* and the sum of *All* bits.

Remote control
`[SENSe]:UECapability:PUPLink?`

Physical Uplink – Physical Channel FDD

The *Physical Uplink – Physical Channel FDD* section describes the capacity of the UE to process and store uplink physical channels:

DPDCH Bits per 10 ms	Maximum number of DPDCH bits the UE can transmit in 10 ms. The value applies to UE operation in non-compressed mode (if the value is <9600) or in both compressed and non-compressed mode (if the value is ≥9600).
PCPCH	Support of the Physical Common Packet Channel (PDSCH). When CPCH is supported, then simultaneous DPCCH & SCCPCH reception is needed.
UE Power Class	Indicates the UE power class as defined in 3GPP TS 25.101, *UE Radio Transmission and Reception (FDD)*.

Remote control
`[SENSe]:UECapability:PUPLink?`

RF Parameters

Tx/Rx Frequ. Separation	Indicates the uplink/downlink frequency separations supported by the UE. This parameter depends on the operating band of the UE.

Remote control
`[SENSe]:UECapability:RFParameters?`

Multi Mode

UTRA FDD/TDD	Indicates whether the UE supports UTRA FDD or TDD.

Remote control
`[SENSe]:UECapability:MMODe?`

Multi RAT

The *Multi RAT* section indicates the Radio Access Technology that the UE supports:

GSM	Indicates whether the UE supports GSM.
Multi-Carrier Mode	Indicates whether the UE supports multi-carrier mode.

Remote control
`[SENSe]:UECapability:MRAT?`

UE Position

The *UE Position* section contains parameters related to UE positioning:

Standalone Loc. Method	Indicates if a UE can measure its location by some means unrelated to UTRAN (e.g. if the UE has access to a standalone GPS receiver).
Network Assisted GPS	Indicates if a UE supports either of the two types of assisted GPS schemes, namely "Network based", "UE based", "Both", or "none".
GPS Reference Time	Indicates if a UE has the capability to measure GPS reference time as defined in standard TS 25.215, *Physical layer - Measurements (FDD)*.
IPDL	Indicates if a UE has the capability to use Idle Periods in the DownLink (IPDL) to enhance its "SFN-SFN observed time difference –type 2" measurement.
OTDOA UE based method	Indicates if a UE supports the Observed Time Difference Of Arrival (OTDOA) UE based schemes.
Rx/Tx Time Difference	Indicates if a UE has the capability to perform the Rx-Tx time difference type 2 measurement.

Remote control
`[SENSe]:UECapability:UEPosition?`

Measurement Related The *Measurement Related* section contains parameters related to inter-frequency or inter-Radio Access Technology (RAT) measurements:

DL Compressed Mode	Indicates whether the UE needs compressed mode in the downlink in order to perform inter-frequency or inter-RAT measurements.
UL Compressed Mode	Indicates whether the UE needs compressed mode in the uplink in order to perform inter-frequency or inter-RAT measurements.

Remote control
`[SENSe]:UECapability:MRELated?`

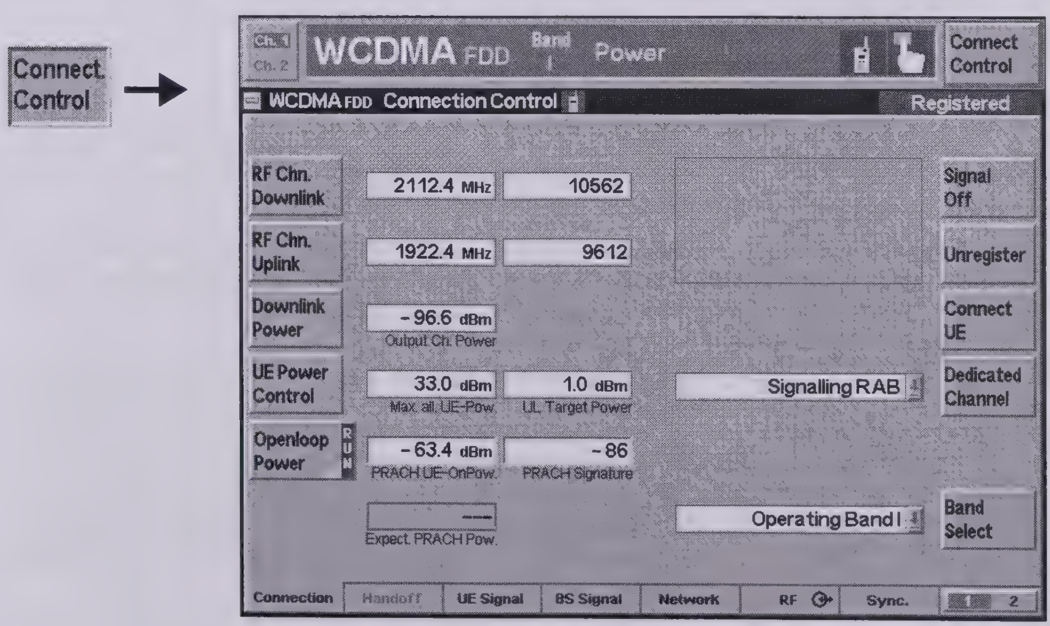
Connection – RF Channel and Power

The CMU provides a second version of the *Connection* tab where the info table on the left side is replaced by softkeys. The softkeys provide the following RF channel and power settings:

- Definition of the RF channel of the BS signal and the UE signal *(RF Chn. Downlink, RF Chn. Uplink).*
- RF power and power control settings *(Downlink Power, UE Power Control)*
- Control of the *Openloop Power* measurement.

The results of the *Openloop Power* measurement and the *Expected PRACH Power* are also displayed on the left side of the tab.

The RF channel and power softkeys are available in all signalling states. The *Connection* hotkey toggles between the two versions of the *Connection* tab if it is pressed repeatedly. The right half with the connection control softkeys is identical in both versions of the tab.


Connect Control
Ch. 1
Ch. 2
WCDMA FDD
Band I
Power
Connect Control
WCDMA FDD Connection Control
Registered
Signal Off
Unregister
Connect UE
Dedicated Channel
Band Select
Connection
Handoff
UE Signal
BS Signal
Network
RF
Sync.
1
2

RF Chn. Downlink 2112.4 MHz 10562
RF Chn. Uplink 1922.4 MHz 9612
Downlink Power −96.6 dBm Output Ch. Power
UE Power Control 33.0 dBm Max. all. UE-Pow. 1.0 dBm UL Target Power
Openloop Power −63.4 dBm PRACH UE-OnPow. −86 PRACH Signature
---- Expect. PRACH Pow.
Signalling RAB
Operating Band I

Fig. 4-75 Connection Control – Connection (RF Channel and Power)

The in the right half of the *Connection* tab are described in the previous section. The left half of the tab contains the following controls:

RF Chn. Downlink

Defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal. The parameters are analogous to the RF generator parameters described in section *Generator Settings (Connection Control – Generator)* on p. 4.109 ff.

Remote control
```
UNIT:BSSignal:CHANnel <Unit>
CONFigure:BSSignal:CHANnel <UARFCN>
```

RF Chn. Uplink

Defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the measured signal. The parameters are described in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.105 ff.

Remote control
```
CONFigure:UESignal:CHANnel <Unit>
UNIT:UESignal:CHANnel <CHANnel>
```

Downlink Power

Defines the total output power of the BS Signal, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits. The parameter is described in section *Downlink Signal (Connection Control – BS Signal)* on p. 4.167 ff.

Remote control
```
CONFigure:BSSignal:OPOWer <UARFCN>
```

UE Power Control

Sets the maximum output power of the UE transmitter (averaged over the transmit slot) and the *UL Target Power*. The settings are also provided in the *UE Signal* tab; see section *Uplink Signal (Connection Control – UE Signal)* on p. 4.163 ff.

Remote control
```
CONFigure:UESignal:PCONtrol:UEPower <Power>
CONFigure:UESignal:PCONtrol:TPOWer:VALue
```

Openloop Power

Controls the PRACH preamble power and signature measurement and indicates its status *(RUN | HLT | OFF)*. Once initiated, the openloop power measurement is re-activated every time that the *Connection Control* menu is opened.

The openloop power measurement is suitable for testing the first power step of the PRACH preamble during random access and verifying compliance with the *Open loop power control tolerance* specified in standard 3GPP TS 34.121. The measurement provides the following results:

PRACH UE-On Pow.	Average (RMS) power of the first PRACH preamble received after the *Openloop Power* measurement is switched on. The preamble power depends on various parameters that can be set in the *UE Signal* tab of the *Connection Control* menu. The PRACH power is averaged over the preamble length of 4096 chips excluding 25 μs (96 chips) at the beginning and at the end of the preamble. The measurement result is in units of dBm.

PRACH Signature Measured signature of the first PRACH preamble received after the *Openloop Power* measurement is switched on. The preamble signature is in the range 0 to 15 and determines the channelization code of the RACH message part; see 3GPP TS 25.213.

Important Note

The Openloop Power *measurement only runs if the underlying TX measurement is turned off. Press the* Connect Control *softkey to close the* Connection Control *menu and check the status of the current underlying measurement.*

The conflict does generally not occur in remote control mode since remote control measurements are typically run in single shot mode.

Performing a PRACH test

PRACH preambles are transmitted during registration and connection setup; see description of random access procedure and Fig. 4-82 on p. 4.179. To obtain a measurement result, proceed as follows:

1. Make sure that all TX measurements are turned off.
2. Open the *Connection Control* menu and press the *Signal Off* softkey in the *Connection* tab.
3. Press *Openloop Power* and the *ON/OFF* key to initiate the openloop power measurement.
4. Press *Signal On* to switch on the *BS Signal.*
5. Switch on the UE.

The UE synchronizes to the BS signal and can attempt a registration towards the CMU. The openloop power results are available after the CMU has received the first PRACH preamble from the UE. The measurement state is *HLT,* the results are not updated when the CMU receives further RACH preambles.

6. To measure the preamble transmitted when a connection is set up, press the 1 / 2 hotkey to access the second group of *Connection Control* tabs. In the *Misc.* tab, deactivate *Close automatically if connected.*
7. Return to the *Connection* tab of the *Connection Control* menu.
8. Press *Openloop Power* and *ON/OFF* to re-start the measurement or simply close and re-open the *Connection Control* menu.
9. Press Connect to UE.

The openloop power results are updated after the CMU has received the first PRACH preamble from the UE.

10. To repeat the entire measurement, switch off your UE (to make sure that it has to register again) and go to step 2.

It is possible to initiate the openloop power measurement during the random access procedure. To be sure to measure the first preamble of the retransmission cycle in this case (the single preamble that meets openloop conditions), it is recommended to set the *Max. Retransmission* parameter in the *Network* tab to 1.

Remote Control

```
INITiate:OLP; ABORt:OLP
FETCh:OLP:STATus?
READ[:SCALar]:OLP?
FETCh[:SCALar]:OLP?
```

Limit check

A red output field and an arrow pointing upwards or downwards indicates that the *PRACH UE-On Power* result differs from the *Expected PRACH Power* indicated below by more than the symmetric upper or lower limit set in the *UE Signal* tab of the *Connection Control* menu.

Remote Control
`CALCulate[:SCALar]:OLP:MATChing:LIMit?`

Expect. PRACH Pow.

Indicates the expected average initial preamble power according to the current settings of the P-CPICH level and the open loop power control parameters (see formula for $P_{preamble}$ on p. 4.166).

Note: *While the Openloop Power measurement is running, the CMU monitors* Expected PRACH Power *and generates an error message if it exceeds the* Max. Allowed UE Power.

Remote control
`READ[:SCALar]:OLP?`
`FETCh[:SCALar]:OLP?`

Handover to GSM (Connection Control – Handover)

The *Handover* tab initiates a handover of the UE registered to an UTRAN cell to a GSM network (circuit switched connection). It is available in the WCDMA signalling states *Registered* and *Connected*. A WCDMA to GSM handover procedure consists of the following stages (see also Fig. 4-78 on p. 4.162):

1. Selection of the GSM destination network *(Destination Selection)*.
2. GSM prepare session with configuration of the essential traffic channel, control channel and network parameters in the GSM network (*Destination Parameters)*.
3. Activation of the GSM cell. If necessary, a GSM BCCH can be superimposed to the UTRAN cell using the *Aux TX* signal (with option R&S CMU-B95, Additional RF Generator. For detailed information on the *Aux TX* signal configuration refer to the operating manual GSMxxx-MS for R&S CMU-B21, stock no. 1115.6088.12).
4. Handover *(Handover,* from the WCDMA *Connected* state only).
5. Return to WCDMA via *Menu Select.*

The *Handover* tab changes its functionality according to the current stage.

Note: *Steps 1 to 3 can be initiated from the WCDMA Registered or WCDMA Connected signalling states. For some mobile types the GSM cell must be set up using the Aux TX signal before the WCDMA connection is established. For a complete overview of the handover states and transitions see Fig. 4-78 on p. 4.162.*

Handover Prerequisites and Conditions

Handover procedures can be initiated between all UTRA/FDD frequency bands and all GSM destination networks. The WCDMA connection must be a voice or a RMC connection; see *Dedicated Channel Type* on p. 4.169. Some mobile types may require additional configurations, e.g. a GSM control channel superimposed to the UTRAN cell (see *GSM Sig. On* softkey).

The CMU supports blind handover from WCDMA to GSM: The UE relies upon the information about the GSM cell transferred in the HANDOVER COMMAND, no check of the destination cell parameters is performed.

Trouble-shooting

If a handover procedure fails, check the following:

- Access the GSM prepare session from the WCDMA *Registered* state and set up a GSM cell before establishing the WCDMA connection.

- Vary the *Handover Activation Time* as described on p. 4.179.

Handover – Destination Selection

In the WCDMA *Registered* or *Connected* state the *Handover* tab provides the following softkeys:

- Selection of the destination network *(Destination Selection).*

The remaining softkeys are disabled until a GSM network is selected.

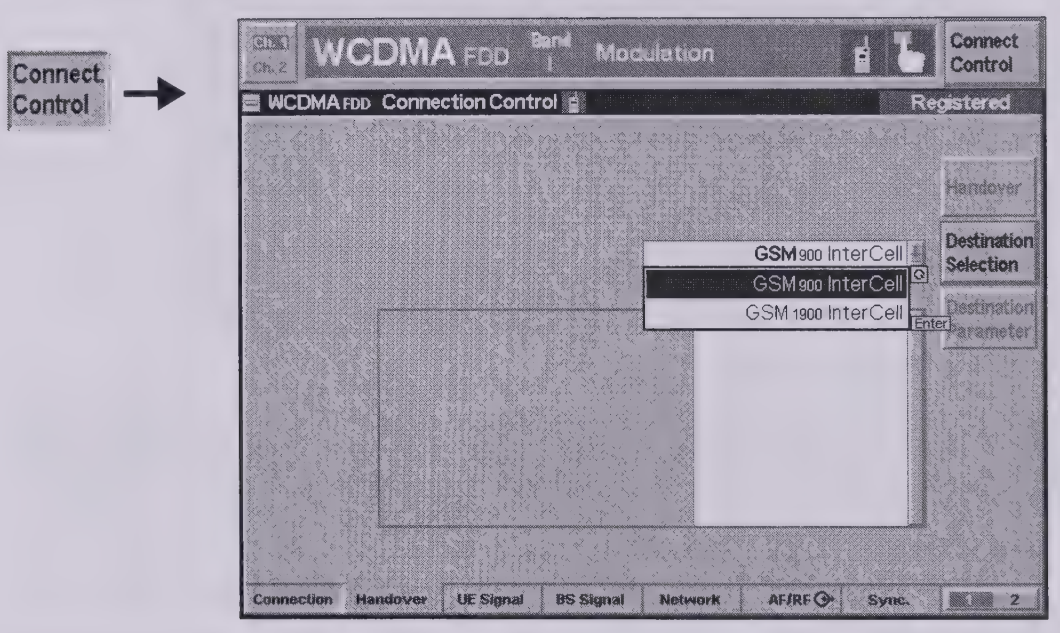

Connect Control
Ch. 1
Ch. 2
WCDMA FDD
Band I
Modulation
Connect Control
WCDMA FDD Connection Control
Registered
Handover
Destination Selection
Destination Parameter
GSM 900 InterCell
GSM 900 InterCell
GSM 1900 InterCell
Enter
Connection
Handover
UE Signal
BS Signal
Network
AF/RF
Sync.
1
2

Fig. 4-76 Connection Control – Handover (destination selection)

Destination Selection

The softkey *Destination Selection* selects the target GSM network for handover.

The drop-down list contains all GSM bands installed on the CMU. Once a band is selected, the CMU changes to the GSM prepare session where it is possible to edit the *Destination Parameters* (see below).

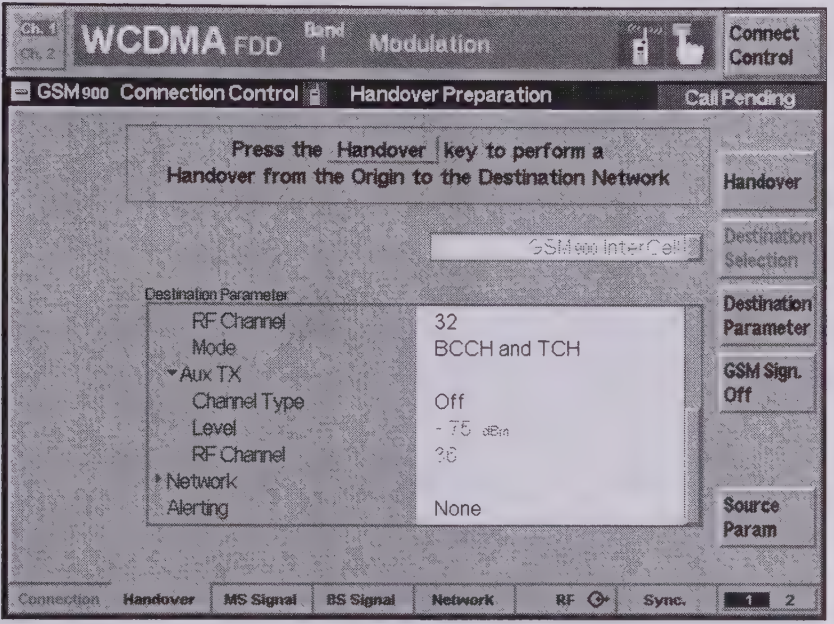
Remote control
`STATus:HANDover:TARGet:LIST?`
`CONFigure:HANDover:TARGet <Target>`

Handover – GSM Prepare Session

Once a GSM destination network is selected the *Handover* tab provides the following softkeys:

- Selection of the essential traffic channel, control channel and network parameters in the GSM network *(Destination Parameters)*
- Loading/unloading of the GSM function group and activation/deactivation of the *Aux TX* signal (if option R&S CMU-B95 is available) and the *Call Pending* state *(GSM Sign. On/GSM Sign. Off)*
- Start of the handover procedure *(Handover)*
- Cancel handover preparations and remain in the original network *(Source Param.)*

Note: Call Pending *is an intermediate signalling state that only occurs in the context of a handover process. For a complete overview of the handover states and transitions see Fig. 4-78 on p. 4.162.*


Ch. 1
Ch. 2
WCDMA FDD
Band I
Modulation
Connect Control
GSM900 Connection Control
Handover Preparation
Call Pending
Handover
Destination Selection
Destination Parameter
GSM Sign. Off
Source Param
Connection
Handover
MS Signal
BS Signal
Network
RF
Sync.
1
2

Press the Handover key to perform a Handover from the Origin to the Destination Network

GSM900 InterCell

Destination Parameter

RF Channel	32
Mode	BCCH and TCH
Aux TX	
Channel Type	Off
Level	- 75 dBm
RF Channel	36
Network	
Alerting	None

Fig. 4-77 Connection Control – Handover (Call Pending)

Destination Parameter

The *Destination Parameter* softkey configures the GSM signals of the destination network and sets the essential network parameters for the handover procedure. All parameters are set in the GSM destination network; they are described in detail in the operating manual for software options CMU-K20/…/24 *(GSMxxxx-MS for CMU-B21),* stock no. 1115.6088.12.

Traffic Channel	GSM channel number, level and used timeslot of the traffic channel.
Control Channel	Control channel parameters. The GSM control channel signal can be provided by the *Main TX* generator or by the *Aux TX* generator (with option CMU-B95, *Additional RF Channel).* If the Aux TX signal is switched on (the Aux TX *Channel Type* is *BCCH),* then a WCDMA downlink channel and a GSM control channel can be superimposed at the same RF output connector; see *GSM Signal Off* softkey below. The *Main TX* parameters are active while the Aux TX signal is switched off; the *Aux TX* parameters are active it is on.
Network	Selects the GSM speech or channel coder *(Traffic Mode)*, the time (number of frames) after which the mobile station starts transmitting a GSM UL signal after receiving the GSM channel *(Starting Time)*, and the data that the GSM network shall request from the mobile *(Requested Mobile Data).*

Alerting	Qualifies whether or not alerting is initiated at the mobile so that it starts ringing before the GSM connection is established. This setting is only relevant if a WCDMA RMC connection (see *Dedicated Channel Type* on p. 4.169) is handed over to GSM; it is ignored for WCDMA voice connections. Alerting *with GSM Setup Message* forces the mobile to set up a GSM speech call, so that both the RF and audio circuits can be tested in the destination network.
Cell Sync.	Selects the procedure for physical channel establishment in a WCDMA to GSM handover; see standard 3GG TS 44.018. In the network, finely synchronized cell synchronization is applied if the MS knows that the timing advance with the new cell is not out of range.

Remote control
All destination parameters are set in the destination network. The following commands are described in the operating manual for software options CMU-K20/.../24

```
CONFigure:BSSignal[:CSWitched][:TCH]…
CONFigure:BSSignal:CCH[:TX]…
CONFigure:BSSignal:CCH:AUXTx…
CONFigure:NETWork[:CSWitched]:SMODe:TRAFfic
CONFigure:NETWork[:CSWitched]:SMODe:STIMe
CONFigure:NETWork[:CSWitched]:REQuest…
CONFigure:HANDover:ALERting ON  OFF
```

GSM Sign. Off

Activates the *Signal Off* state where the Aux TX signal is always switched off and the GSM function group is no longer initialized. In the *Signal Off* state, *GSM Sign. Off* is replaced by *GSM Sign. On* to return back to the *Signal Pending* state from where a handover to GSM can be initiated (see Fig. 4-78 on p. 4.162). To this end *GSM Sign. On* initializes the GSM function group, which takes a short while.

The exact function of *GSM Sign. Off*/*GSM Sign. On* depends on the *Aux TX* signal configuration (see *Destination Parameters* above):

- If the *Aux TX* signal is switched on (the Aux TX *Channel Type* is *BCCH),* then *GSM Sign. On* switches on the Aux TX signal providing the GSM control channel and activates *Call Pending.* The mobile can receive the GSM control channel while it is still connected to the UTRAN cell. Some mobiles require this scenario for a successful handover initiation. *GSM Sign. Off* switches the Aux TX signal off.
- If the *Aux TX* signal is switched off (or if option CMU-B95 is not available), then *GSM Sign. On* activates *Call Pending* without switching on a GSM control channel signal. The GSM signal is generated when handover is initiated and replaces the WCDMA downlink signal.

Aux TX can be switched on or off in both the *Signal On* and *Call Pending* state. The main purpose of the *GSM Sign. Off*/*On* toggle softkeys is to switch on or off Aux TX with a single keystroke.

Remote control

```
PROCedure:SIGNalling:HANDover:TARGet:PREPare ON | OFF
```

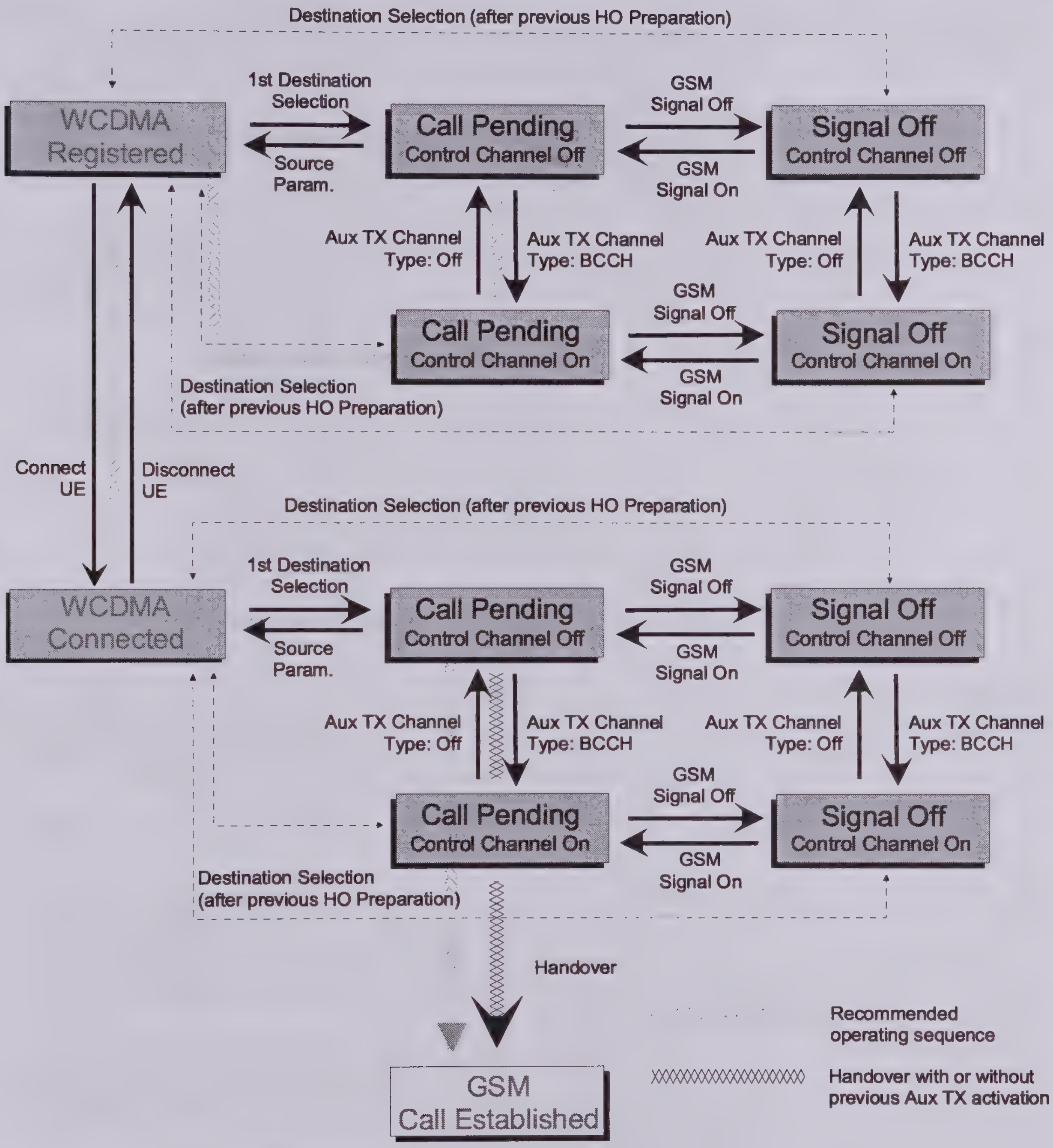

Destination Selection (after previous HO Preparation)
1st Destination Selection
Source Param.
WCDMA Registered
Call Pending Control Channel Off
GSM Signal Off
GSM Signal On
Signal Off Control Channel Off
Aux TX Channel Type: Off
Aux TX Channel Type: BCCH
Aux TX Channel Type: Off
Aux TX Channel Type: BCCH
Call Pending Control Channel On
GSM Signal Off
GSM Signal On
Signal Off Control Channel On
Destination Selection (after previous HO Preparation)
Connect UE
Disconnect UE
Destination Selection (after previous HO Preparation)
WCDMA Connected
1st Destination Selection
Source Param.
Call Pending Control Channel Off
GSM Signal Off
GSM Signal On
Signal Off Control Channel Off
Aux TX Channel Type: Off
Aux TX Channel Type: BCCH
Aux TX Channel Type: Off
Aux TX Channel Type: BCCH
Call Pending Control Channel On
GSM Signal Off
GSM Signal On
Signal Off Control Channel On
Destination Selection (after previous HO Preparation)
Handover
GSM Call Established
Recommended operating sequence
Handover with or without previous Aux TX activation

Fig. 4-78 Handover State Machine

Handover

The *Handover* softkey initiates a handover to the destination GSM network. This softkey is only available if the CMU was in the *Connected* state before entering the handover preparation session.

The basic steps to initiate a handover and the most common error sources are described in section *Handover to GSM (Connection Control – Handover)* beginning on p. 4.158.

Remote control
`PROCedure:SIGNalling:ACTion HANDover`

Source Param.

The *Source Param.* softkey terminates the handover preparation session so that the CMU returns to the WCDMA *Registered* or *Connected* signalling state.

The destination parameters defined in the *Signal Off* or *Call Pending* state are maintained and the *Handover* softkey is still active. To cancel the *Handover* procedure and return to the measurement mode, press the *ESCAPE* key or the *Connection Control* softkey.

Remote control
–

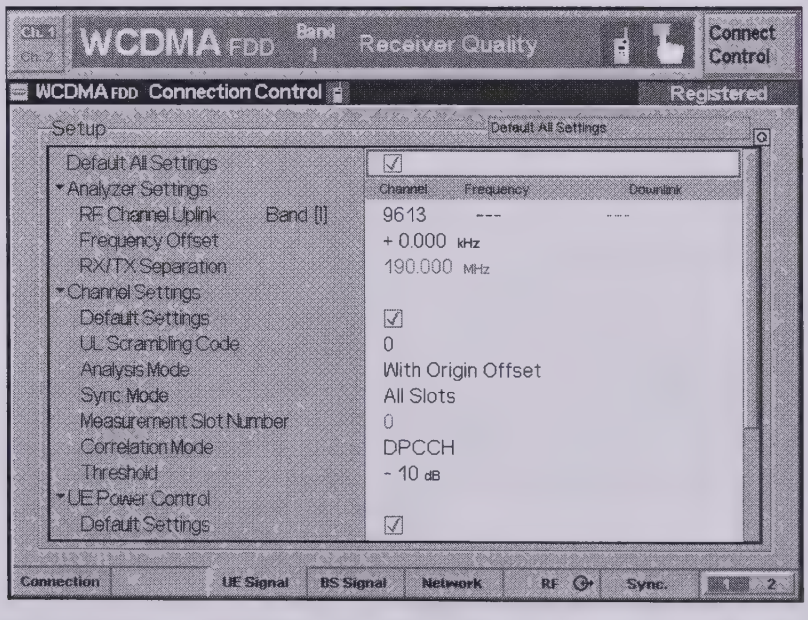
Uplink Signal (Connection Control – UE Signal)

The *UE Signal* tab defines the RF input signal. This comprises:

- Inclusion of a possible origin offset in the measurement results *(Analysis Mode)*
- The frequency of the measured signal *(Analyzer Settings)*
- The channel characteristics of the measured signal *(Channel Settings)* including the synchronization settings *(Sync. Mode, Measurement Slot Number, Correlation Mode, Threshold)*
- Parameters for *Open Loop Power Control*

Some settings may not be available in all signalling states of the CMU. Exact description is provided in the remote control command description in Chapter 6.

Connect. Control →


Ch. 1
Ch. 2
WCDMA FDD
Band 1
Receiver Quality
Connect Control
WCDMA FDD Connection Control
Registered
Setup
Default All Settings
Channel
Frequency
Downlink
Connection
UE Signal
BS Signal
Network
RF
Sync.
1
2

Default All Settings	☑
Analyzer Settings	
RF Channel Uplink Band [I]	9613 ---
Frequency Offset	+ 0.000 kHz
RX/TX Separation	190.000 MHz
Channel Settings	
Default Settings	☑
UL Scrambling Code	0
Analysis Mode	With Origin Offset
Sync Mode	All Slots
Measurement Slot Number	0
Correlation Mode	DPCCH
Threshold	- 10 dB
UE Power Control	
Default Settings	☑

Fig. 4-79 Connection Control – UE Signal

Default Settings

The *Default All Settings* switch assigns default values to all settings in the *UE Signal* tab (the default values are quoted in the command description in Chapter 6). Additional default switches are provided for the individual section in the *UE Signal* tab.

Remote control
`DEFault:UESignal`
`DEFault:UESignal:PCONtrol`

Analyzer Settings

The *Analyzer Settings* section defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the measured signal and an offset to this carrier frequency. The parameters are described in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.105 ff. They can be changed in all signalling states including *Connected.*

Remote control

```
CONFigure:UESignal:CHANnel <Unit>
UNIT:UESignal:CHANnel <CHANnel>CONFigure:UESignal:FOFFset
<Offset>
```

Channel Settings

The *Channel Settings* section configures the UL WCDMA signal generated by the UL.

UL Scrambling Code	Number of the long code that the UE shall use to scramble the uplink WCDMA signal; see *Fig. 4-13* on p. *4.34.* The scrambling code number must be in the range 0 to FFFFFF (hex) corresponding to 0 to 16777215 decimal.
Analysis Mode	The *Analysis Mode* parameter selects whether a possible origin offset is included in the measurement results or subtracted out. The analysis mode has an impact on most of the parameters determined in a *Modulation* measurement and on the modulation (EVM) results indicated in the *Code Domain Power* menus. For detailed information refer to p. 4.127.

The following synchronization settings are described in detail in section *Uplink Signal (Connection Control – UE Code)* on p. 4.127 ff. The settings *Sync. Mode, Meas. Slot Number, Correlation Mode,* and *Threshold* are relevant for *Code Domain Power* measurements.

Sync. Mode	Method that the CMU uses to synchronize to the captured (channel coded and scrambled) uplink WCDMA signal and analyze the slot number.
Meas. Slot Number	Slot number to be measured in the range 0 to 14. The CMU expects this slot to be captured if *Sync. Mode* is set to *Synchronous*. In the *All Slots* mode, the *Measured Slot Number* is ignored.
Correlation Mode	Defines which DPCH contributions are used for the correlation analysis. The *DPCCH + DPDCH* mode improves the reception of the UE signal, especially if a large frequency offset occurs or if the DPCCH level is much smaller than the DPDCH level. On the other hand the DPCCH mode accelerates the measurement.
Threshold	Minimum signal strength of each DPDCH_n in the WCDMA signal to be detected in the automatic channelization code search. The threshold is defined as a ratio of the individual DPDCH_n to the DPCCH and expressed in dB. If $\text{DPDCH}_n/\text{DPCCH} <$ Threshold, DPDCH_n is not detected.

Remote control

```
CONFigure:UESignal:SCODe:SECondary <Code>
CONFigure:UESignal:AMODe WOOFfset | WIOFfset
CONFigure:UESignal:DPCH:SYMode
CONFigure:UESignal:DPCH:SNUMber
CONFigure:UESignal:DPCH:CMODe
CONFigure:UESignal:DPDCh:AUTo:THReshold
```

UE Power Control

The *UE Power Control* section sets the maximum power of the UE and parameters required to define the initial power of the UE at random access *(Open Loop* power control).

Max. All. UE Power	Maximum output power of the UE transmitter (averaged over the transmit slot). WCDMA user equipment is divided into four power classes. In standard 3GPP TS 25.101, the maximum output power of the UE transmitter (averaged over the transmit slot) and its tolerance is defined according to the power class of the UE as shown in *Table 4-20 below.* A *Max. Allowed UE Power* below the maximum output power further restricts the output power range of the UE. The *Max. Allowed UE Power* and the maximum *Analyzer Level* are independent parameters, however, the UE power should be below the maximum *Analyzer Level.*
UL Target Power	Fixed output power of the UE transmitter. The value is used if the *TPC Pattern Type* (see p. 4.174) in the *BS Signal* tab of the *Connection Control* menu is set to *Closed Loop* and if a connection is set up: in this case the CMU sends a TPC pattern to the UE to command it to the target power. The target power is not relevant for the other pattern types. The meaning of *UL Target Power* depends on the *UL Target Power Type,* see below.

Note: *Correct setting of the UE target power requires a level calibration of the TX and RX path. To do this, open the* Menu Select *menu, select* Basic Functions – Base – Maintenance *and run the* L1CoPro Level Calib. *test.*

UL Target Power Ref.	Target power reference, i.e. the UL signal contribution that is used as the *UL Target Power.* The *Total Power* corresponds to the average slot power *(UE Power)* displayed in many measurement menus. Selecting the (constant) *DPCCH Power* as a reference results in a larger UE transmit power. The power difference depends on the *Dedicated Channel Type (see p.* 4.169*)* and the data rate: • *If an RMC is allocated, the power difference is fixed. It depends on the weighting factors β_c and β_d which are given in terms of the data rate.* • *If a voice channel is allocated, the power difference varies as a function of the data traffic.*

The power of the control and data channels in the UL signal can be monitored in the *Code Domain Power* menu.

Typical application: Change UL Target Power and monitor the received UE Power

1. Establish a connection to the DUT.
2. Open the *BS Signal* tab of the *Connection Control* menu and select *Closed Loop* as the TPC pattern type of the active setup.
3. Open the *UE Signal* tab of the *Connection Control* menu and make sure that the *UL Target Power Type* is *Total Power.*
4. Close the *Connection Control* menu and access the *Power, Modulation* or *Code Domain Power* menu.
5. Press *UE Signal – UL Target Power* and vary the target power. Observe the *UE Power* output field and check whether the UE follows the target power.

Remote control

`CONFigure:UESignal:PCONtrol:UEPower <Power>`

```
CONFigure:UESignal:PCONtrol:TPOWer:VALue
CONFigure:UESignal:PCONtrol:TPOWer:REFerence
```

Table 4-20 Maximum output power

Power Class	**Maximum Output Power (Rated Value)**	**Tolerance**
1	+33 dBm	+1/-3 dB
2	+27 dBm	+1/-3 dB
3	+24 dBm	+1/-3 dB
4	+21 dBm	±2 dB

Open Loop Power Control

The *Open Loop Power Control* section sets the parameters required to define the initial power of the UE at random access. According to standard TS 25.331, the UE calculates the initial preamble power (prior to PRACH or PCPCH transmission; see *Fig. 4-82 below*) as follows:

$P_{preamble}$ = *UL Interference + Constant Value + Reported P-CPICH Power* – CPICH_RSCP

When establishing the first DPCCH, the UE starts the UL inner loop power control at the following power level:

P_{DPCCH} = *DPCCH Power Offset* – CPICH_RSCP

CPICH_RSCP denotes the CPICH Received Signal Code Power, i.e. the received signal power on one code, measured by the UE on the pilot bits of the P-CPICH. This power corresponds to the P-CPICH Power at the CMU connector, to be set in the *BS Signal* tab (see section *Downlink Signal (Connection Control – BS Signal)* on p. 4.167 ff.). The parameters written in italics are broadcast to the UE as defined in the *Open Loop Power Control* section.

UL Interference	Estimated UL interference in dBm, contained in System Information Block type 7. In a network, the *UL Interference* can change fast. A large interference value increases the initial preamble power.
Constant Value	Constant offset for the initial preamble power. The larger the constant value, the larger the initial preamble power.
Reported P-CPICH Power	DL Primary CPICH TX power reported to the UE. In the network, the *Reported P-CPICH Power* is the actual Node B transmit power, the DL path loss is equal to the difference *Reported P-CPICH Power – CPICH_RSCP.* The larger the path loss, the larger the initial preamble power.
Note:	*The CMU simulates a real network, although the exact meaning of the power control parameters and their individual values are of minor importance. According to the formula for $P_{preamble}$ quoted above, increasing any of the parameters* UL Interference, Constant Value, Reported P-CPICH Power *increases the initial preamble power, increasing the P-CPICH power in the* BS Signal tab *decreases the initial preamble power. The default reported P-CPICH power is much larger than the actual power of the BS signal; the order of magnitude of the simulated pathloss is 80 dB.*
DPCCH Power Offset	Reference value for the initial DPCCH power of the UE: The larger the *DPCCH Power Offset,* the larger the initial DPCCH power.

PRACH UE On Power Limit	Tolerance value for the *Openloop Power* measurement (see. p. 4.156). According to standard 3GPP TS 34.121, *Open Loop Power Control in the Uplink*, the openloop power must not differ from the *Expected PRACH Power* by more than ±dB.

Remote control

```
CONFigure:UESignal:PCONtrol:OLPC:INTerference
CONFigure:UESignal:PCONtrol:OLPC:CVALue
CONFigure:UESignal:PCONtrol:OLPC:PCPich:RPower
CONFigure:UESignal:PCONtrol:OLPC:DPCCh:POFFset
CONFigure:OLP:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
```

Downlink Signal (Connection Control – BS Signal)

The *BS Signal* tab configures the CMU's operating mode and the generated DL WCDMA signal. It defines:

- The frequency of the generated signal, the scrambling code and general power settings *(Node B Settings)*
- The type and the properties of the *Dedicated Channel* to be allocated between the UTRAN/CMU and the UE.
- The properties of all *Physical Channels* contributing to the BS Signal
- The Transmit Power Control settings *(TPC Settings)*

Some settings may not be available in all signalling states of the CMU. Exact description is provided in the remote control command description in Chapter 6.

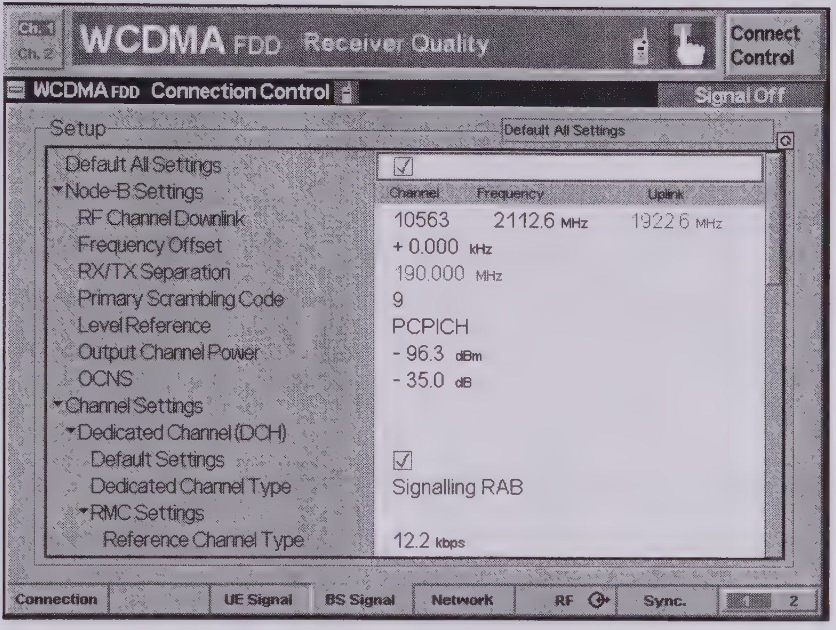
Downlink WCDMA Signal

The BS signal is a RF signal with DL WCDMA characteristics that the CMU transmits to emulate a UTRAN cell and communicate with the UE under test. The UE can synchronize to the BS signal, initiate a registration/location update towards the network, and set up an RRC connection using different dedicated channel types. The BS signal has the following physical channel contributions:

- The synchronization channels P-CPICH, P-SCH and S-SCH
- The broadcast channels P-CCPCH, S-CCPCH, PICH, AICH (necessary to set up a connection)
- The dedicated physical channel DPCH (DPDCH, DPCCH)

The *BS Signal* tab defines the physical properties of the BS signal. Most of them are analogous to the properties of the RF generator signal described on p. 4.109 ff. Parameters involving higher layers can be set in the *Network* tab of the *Connection Control* menu.

Connect. Control →



Default All Settings	☑		
Node-B Settings	Channel	Frequency	Uplink
RF Channel Downlink	10563	2112.6 MHz	1922.6 MHz
Frequency Offset	+ 0.000 kHz		
RX/TX Separation	190.000 MHz		
Primary Scrambling Code	9		
Level Reference	PCPICH		
Output Channel Power	- 96.3 dBm		
OCNS	- 35.0 dB		
Channel Settings			
Dedicated Channel (DCH)			
Default Settings	☑		
Dedicated Channel Type	Signalling RAB		
RMC Settings			
Reference Channel Type	12.2 kbps		

Fig. 4-80 Connection Control – BS Signal

Default Settings The *Default All Settings* switch assigns default values to all settings in the *BS Signal* tab (the default values are quoted in the command description in Chapter 6). Additional default switches are provided for the individual section in the *BS Signal* tab.

Remote control
`DEFault:BSSignal`

Node B Settings The *Node B Settings* section defines the carrier frequency and channel number (UARFCN, UTRA Absolute Radio Frequency Channel Number) of the generated signal, an offset to this carrier frequency and the primary scrambling code for the DL WCDMA signal. The parameters are analogous to the RF generator parameters described in section *Generator Settings (Connection Control – Generator)* on p. 4.109 ff. The RF channel and frequency offset can be changed in all signalling states including *Connected* (inter-frequency handover).

Level Reference Defines whether the power of all channels is expressed relative to the P-CPICH *(PCPICH)* or to the *Output Channel Power.*

Output Ch. Power Total output power of the BS signal, averaged over 1 frame but not taking into account a possible DTX mode for the TFCI bits.

Note: *The* Output Ch. power *is stored whenever the CMU reaches the* Connected *state and reused when the* Connected *state is released. This ensures that a change of the* BS Signal *level during the connection (e.g. a reduced level for a* Receiver Quality *test) does not impair the next connection.*

OCNS Level of the Orthogonal Channel Noise Simulator (OCNS, see description on p. 4.115) relative to the *Output Channel Power* or to the *P-CPICH* level, depending on the selected *Level Reference.*

Remote control
```
UNIT:BSSignal:CHANnel <Unit>
CONFigure:BSSignal:CHANnel <UARFCN>
CONFigure:BSSignal:FOFFset <Offset>
CONFigure:BSSignal:SCODe:PRIMary
CONFigure:BSSignal:LREFerence <Reference>
```

```
CONFigure:BSSignal:OPOWer <Abs_Power>
CONFigure:BSSignal:OCNS <Rel_Power>
```

Channel Settings Dedicated Channel

The *Dedicated Channels* table section selects the dedicated channel type and configures the Reference Measurement Channel *(RMC)*, the *Voice Settings* and the Signalling Radio Bearer *(SRB).*

Dedicated Channel Type

Dedicated Channel Type selects the dedicated channel to be allocated between the CMU/UTRAN and the UE.

Signalling RAB	The CMU uses a Signalling Radio Bearer (SRB) of variable data rate to establish and maintain the connection. The SRB is configured in the *Signalling RAB Settings* subsection. This simple and fast connection type can be used for TX measurements.
RMC	The CMU uses a fixed 2.5 kbps Signalling Radio Bearer (SRB) to set up a connection and allocate a Reference Measurement Channel. The Dedicated Channel configuration in the *Connected* state depends on the *Test Mode* settings; see *RMC Settings* subsection.
Voice	The CMU uses a fixed 3.4 kbps Signalling Radio Bearer (SRB) to set up a connection and allocate a voice channel. The voice channel is configured in the *Voice Settings* subsection. The CMU can loop back the received speech data or make TX measurements on the received signal.
Note:	*A handover to a GSM network requires an* RMC *or* Voice connection*; see section Handover to GSM (Connection Control – Handover)* on p. 4.159 *ff.*

Remote control

```
CONFigure:BSSignal:DCH:TYPE  RMC | VOIC | SRAB
```

RMC Settings

The *RMC Settings* section configures a 3GPP reference measurement channel and selects an UE test mode. The *RMC Settings* take effect when an RMC connection is established *(Dedicated Channel Type = RMC;* see above).

According to 3GPP TS 25.101, the data content of the *3GPP DL Reference Channel* is defined on transport channel level. The data sequence to be transferred is directly fed into the Dedicated Traffic Channel (DTCH) and Dedicated Control Channel (DCCH). The transport channels are channel coded, multiplexed and mapped onto a Dedicated Physical Channel (DPCH) with variable data rate. For more information see paragraphs on the *3GPP DL Reference Channel* on p. 4.121 ff.

Reference Channel Type	Information bit rate of the downlink and uplink reference channel (12.2 kbps, 64 kbps, 144 kbps, or 384 kbps). The information bit rate determines various physical and transport channel parameters of the reference channel. An example (12.2 kbps) is given in *Table 4-12* and *Table 4-13*. The slot formats of the reference channels are 11 (for 12.2 kbps), 13 (64 kbps), 14 (144 kbps), and 15 (384 kbps). At high data rates (144 kbps or 384 kbps), the energy per symbol decreases so that it can be necessary to increase the signal level. The CMU provides asymmetric RMC data rates in the downlink and in the uplink. *Receiver Quality* tests can be performed with asymmetric RMCs; see

section *Test Loops for BER, BLER and DBLER Tests.*

DL Resources in Use

Relative number of DL RMC transport blocks that are filled with information bits. An integer factor n means that out of n transport blocks, only one is fully filled with data, (n – 1) blocks are empty. The effective data rate decreases by the factor 1/n.

Restricting the DL resources can be necessary to prevent a buffer overflow in the UE, especially in cases where BLER tests are performed with asymmetric RMCs with a different Transmission Time Interval (TTI) for the DL and UL (384 kbps DL RMC and a lower-rate UL RMC, see also section *Test Loops for BER, BLER and DBLER Tests* on p. 4.93).

Note: *The uplink DPDCH is only active (and filled with data) as long as the UE transmits data. In closed test loop mode, this means that the DPDCH power and therefore the total UL power decreases if the effective DL data rate is reduced (i.e. if a larger factor for* DL Resources in Use *is selected).*

The variation of the total UL power as a function of the DL Resources in Use *should be kept in mind if closed loop Transmit Power Control of the UE is used (TPC Pattern Type = Closed Loop). To exclude an impact of the* DL Resources in Use*, the UL Target Power (see p. 4.165) can be defined relative to the constant DOCCH power.*

Uplink CRC

If the uplink Cyclic Redundancy Check is enabled *(On),* the UE sends a 16-bit CRC sequence, the DL/UL transport block size is symmetric and the CMU can measure the BER and DBLER (see Chapter 1 and section *Test Loops for BER, BLER and DBLER Tests* on p. 4.186 f.). If the uplink Cyclic Redundancy Check is disabled *(Off),* the UE sends no CRC sequence, the DL/UL transport block size is asymmetric and the CMU can measure the BER, DBLER and BLER.

The *Uplink CRC* can be disabled *(Off)* only if *Loop Mode 2* is active and a symmetric *Reference Channel Type* is selected.

Test Mode

Operating mode that the UE enters after connecting to the UTRAN/CMU. The test mode is a stable connected state of the UE which can be quickly accessed. It belongs to the UE conformance testing functions specified in standard TS 34.109.

If the test mode is switched *Off,* the CMU attempts to set up a standard connection and allocate an RMC without forcing the UE to the test mode.

If the test mode is switched *On,* the CMU sets up an RMC connection and forces the UE to the UE radio bearer test mode. The connection is fast (without *Alerting)* and must be initiated by the CMU.

If the *Loop Mode 1 RLC TM/Loop Mode 2* test mode is selected, the CMU sets up an RMC connection and forces the UE to the UE test loop mode 1 or 2. The loop modes are submodes of the UE radio bearer test mode, suitable for RX tests. The connection is fast (without *Alerting)* and must be initiated by the CMU.

Note: *RMC connections leading to UE test modes* (Test Mode = On *or* Loop Mode 1 RLC TM/Loop Mode 2) *must be initiated from the CMU (MTC only). The connections are faster than any other connection types because the* Alerting *state is skipped. An attempt to initiate a connection from the UE (MOC) while* Test Mode = On *or* Loop Mode 1 RLC TM/Loop Mode 2 *results in an error message.*

The use and functionality of the three test mode settings is listed in Table 4-21 below.

Channel Data Source DTCH	Bit pattern transmitted as user information on the DTCH: Bit sequence consisting of zeros *(All 0)*, ones *(All 1)* 010101... *(Alternating)*, or pseudo-random bit sequences of variable length *(PRBS9, PRBS11, PRBS13, PRBS15).*

Remote control

```
CONFigure:BSSignal:DCH:RMC:RTYPE <Rate>
CONFigure:BSSignal:DCH:RMC:UCRC <Enable>
CONFigure:BSSignal:DCH:RMC:TMODe OFF  | ON | MODE2
CONFigure:BSSignal:DCH:RMC:SDTCh <Sequence>
```

Table 4-21 Overview of RMC test modes

Test Mode	Off	On	Loop Mode 1/2
Connection setup	MTC or MOC	MTC without Alerting	MTC without Alerting
UE test mode	–	UE radio bearer test mode	UE test loop mode 1/2 UE loops back data and CRC
Supported measurements	TX tests	TX tests	TX tests, RX tests
Purpose	RMC connection for UEs under development that do not support the test modes	Fast RMC connection for TX tests	Fast RMC connection for Receiver Quality tests

Voice Settings The *Voice Settings* section configures the voice channel. The *Voice Settings* take effect when a voice channel connection is established *(Dedicated Channel Type = Voice;* see above).

Voice Settings – Voice Source Selects the signal path for voice data:

Echo	The CMU uses loopback with delay, i.e. it sends back all data received on the dedicated channel after a delay time without invoking the speech coder.
Off	Nothing is looped back.
Codec	The CMU sends and receives speech data that is routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is amplified by 22.5 dB.
Codec Low	The CMU sends and receives speech data that is routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is not amplified.
Decoder Cal	The speech codec (option CMU-B52) provides a 1 kHz sinewave signal at its analog output. This signal is used for external calibration

	of the analog output paths.
Encoder Cal	The speech codec (option CMU-B52) loops the input signal after digital/analog conversion directly to the analog output. This signal is used for external calibration of the analog input paths.
Codec Cal	The CMU sends and receives speech data that is routed to the internal speech codec (option CMU-B52). Analog signals are provided via the *SPEECH* connector at the front panel of the instrument. The analog input signal at connector *SPEECH* is not amplified. The CMU sends a close loop message to the UE to activate an internal test loop.

Voice Settings – AMR

Adaptive Multi Rate (AMR)

Active Code Set	Code sets A to M. The Active Codec Set (ACS) contains a subset of the UMTS AMR (Adaptive Multi-Rate) codec modes that can be selected for transmission. According to standard 3GPP TS 26.103, the ACSs in uplink and downlink are identical. The active code sets A to H correspond to a fixed single data rate. The data rates are mapped in descending order so that code set A corresponds to the highest data rate, code set H to the lowest data rate of the AMR speech coder. Code set M is a set with 4 different data rates.
Codec Modes	The codec modes for all ACSs are viewed in a graphical overview. The modes are valid in uplink and downlink.

Selecting one of the Codec Modes A to M means that a fixed codec mode is used in both the uplink and the downlink so that it is possible to perform voice tests at any fixed data rate. In mode M, the CMU and the UE can use one of 4 different data rates (active codec modes). In *Echo* mode, the UL and DL codec modes are always equal.

A possible application of mode M is to send an *All 1* TPC pattern to the UE under test until it reaches its maximum output power and is forced to select a lower data rate. The active codec mode must be monitored at the UE itself.

Remote control
```
CONFigure:BSSignal:DCH:VOICe:SOURce <Mode>
CONFigure:BSSignal:DCH:VOICe:ACSet A to H | M
```

Signalling RAB Settings

The *Signalling RAB Settings* section selects the SRB (Signalling Radio Access Bearer) used to set up and maintain the connection. The *Signalling RAB Settings* take effect when a SRB connection is established *(Dedicated Channel Type = Signalling RAB;* see above). The other connection types are set up with a fixed-rate SRB.

SRB	Data rate of the SRB in kbit/s. To test the capabilities of the UE, several data rates are provided.

Remote control
```
CONFigure:BSSignal:DCH:SRAB:SRB K2_5 | K3_4 | K13_6
```

Channel Settings Downlink Physical Channels

The *Downlink Physical Channels* section defines the level of the P-CPICH, P-SCH, S-SCH, P-CCPCH, the PICH and the DPDCH (see section *Panel Oriented Version* on p. 4.113 ff.).

Note: *The P-CPICH can be entered in absolute units (dBm) and used as a reference for all other (relative) levels (see* Level Reference *setting above). Synchronization of the UE is described in section Downlink Channels and Synchronization on p.* 4.110 *ff.*

In addition the section defines the channelization codes for the PICH and the DPCH as well as the DPCCH/DPDCH power offset and the secondary scrambling code the of the DDPCH (see p. 4.118 f.). Besides it configures two channels that carry higher-layer messages and are therefore not part of the RF generator signal:

S-CCPCH	Level of the Secondary Common Control Physical Channel relative to the *Level Reference;* see above.
S-CCPCH Channel. Code	Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the S-CCPCH. The set of possible code numbers is the same as for the DPCH: They depend on the spreading factors SF and range from 0 to SF – 1. The spreading factors are given by the slot format (slot format numbers 0 to 16 for physical channels; see *Table 4-14* on p. 4.124) which in turn is a function of the information bit rate for 3GPP reference measurement channels (see description of Reference Channel Type parameter on p. 4.169). The channelization codes $c_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the S-CCPCH, the DPCH, the PICH, and the AICH must be compatible. The CMU auto-corrects incompatible entries; see background information on *PICH/DPCH channelization codes* on p. 4.120.
AICH	Level of the Acquisition Indicator Channel relative to the *Level Reference;* see above.
AICH Channel. Code	Channelization code (Orthogonal Variable Spreading Code, OVSC) number assigned to the AICH. The AICH is a fixed rate (SF = 256) physical channel with channelization code numbers ranging from 2 to 255. The channelization codes $c_{256,0}$ and $c_{256,1}$ are reserved for the P-CPICH and P-CCPCH, respectively, and can not be assigned. Besides the channelization codes for the AICH, the PICH, the DPCH, and the S-CCPCH must be compatible. The CMU auto-corrects incompatible entries; *PICH/DPCH channelization codes* on p. 4.120.

Remote control

```
DEFault:BSSignal:PHYSical
CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary
CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary
CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary
CONFigure:BSSignal:PHYSical:LEVel:PICH
CONFigure:BSSignal:PHYSical:LEVel:AICH
CONFigure:BSSignal:PHYSical:LEVel:DPDCh
```

`CONFigure:BSSignal:PHYSical:Level` sets all channel levels at once (recommended command)

```
CONFigure:BSSignal:PHYSical:CODE:DPDCh
CONFigure:BSSignal:PHYSical:DPCH:POFFset  <Level>
CONFigure:BSSignal:SCODe:SECondary
```

TPC Settings The *TPC Settings* section defines the uplink Transmit Power Control (TPC) parameters transferred to the UE.

TPC Algorithm	Power control algorithm 1 or 2 used to control the UE transmit power. See background information below.

TPC Step Size	Relative power difference of the UE between two consecutive slots if the power control algorithm commands the R&S CMU to change its output power. The step size is always a positive dB value (1 dB or 2 dB); the actual generator power may be increased or decreased by the step size, depending on the *TPC Algorithm*.
Note:	*According to the standard, the TPC step size for Algorithm 2 is always 1 dB. The step size for Algorithm 1 can be 1 dB or 2 dB.*

The CMU provides five different predefined setups with different TPC patterns. It is possible to select one of these TPC patterns or modify each pattern according to the needs of a specific application.

TPC Pattern Setup	Selects the TPC pattern setup to be used. All setups no. 01 to 05 are defined by the *TPC Pattern Type* and the single *Pattern;* see *Table 4-22 below.*
TPC Pattern Type	TPC command sequence transferred to the UE. Together with the power control algorithm, the TPC profile determines the power steps of the UE transmitter between consecutive slots. ***Note: Closed Loop pattern type*** In addition to the pattern types provided in Non Signalling mode (see *Table 4-16* on p. 4.125), a *Closed Loop* pattern type is available in Signalling mode. *Closed Loop* means that the CMU generates a TPC pattern that will command the UE to transmit at the *UL Target Power* defined in the *UE Signal* tab (see p. 4.165). Closed Loop is suspended if a *Min. Power, Max. Power* or *Spectrum* measurement is switched on, see *Table 4-23* below. *Pattern* TPC command sequence of finite length (single pattern) used to construct the pattern transferred to the UE; see *TPC Profile* above.
Repeat Pattern	Enabled for *TPC Pattern Type = Single Pattern + All 0, Single Pattern + All 1* or *Single Pattern + Alternating.* Selecting *On* terminates the running alternating bit sequence at the next matching frame boundary and replaces it by <Pattern>000..., <Pattern>111..., or <Pattern>(0)10010...; see *Table 4-16* and *rules for the transfer of TPC patterns* on p. 4.124. The function is afterwards switched back to the *Off* state. The function can be used repeatedly to insert single patterns into the bit sequence.

For more information refer to p. 4.124.

Remote control

```
CONFigure:BSSignal:TPC:MODE
CONFigure:BSSignal:TPC:SSIZe
CONFigure:BSSignal:TPC:PSET<nr>
CONFigure:BSSignal:TPC:PTYPe<nr>
CONFigure:BSSignal:TPC:PATTern<nr>
CONFigure:BSSignal:TPC:RPATtern
```

The default patterns are inspired by the conformance test specification 3GPP TS 34.121

Table 4-22 Default TPC Patterns: Signalling

Setup No.	TPC Pattern Type	Pattern	Description
6	Closed loop	01	UE transmits at *UL Target Power*, pattern ignored.
7	Single Pattern + Alternating	1111111111	UE increases its output power on each <Repeat Pattern> event; otherwise it maintains its power.
8	Single Pattern + Alternating	0000000000	UE increases its output power on each <Repeat Pattern> event; otherwise it maintains its power.
9	Continuous Pattern	1111111111 0000000000	UE periodically increases and decreases its output power in 10-slot intervals. The average UE power over 20 slots is constant irrespective of the TPC algorithm.
10	Continuous Pattern	1000001001 1111011010	UE increases and decreases its output power according to an irregular pattern that contains one set of 5 consecutive "0" and "1" commands which both do not commence in the 1st, 6th or 11th slots of a frame (see TS 34.101). The average UE power over 20 slots is constant irrespective of thefor TPC algorithm 1; for TPC algorithm 2 the UE power does not change.

Table 4-23 UE power depending on measurement settings

Measurement	Measurement Settings	TPC Pattern Type	UE Power
Min. Power Max. Power6)	TPC = Automatic UL Target Power = x dBm	All patterns, set before measurement is switched on	TPC pattern suspended during the measurement, UE transmits at its minimum or maximum power. UL target power ignored.
		Closed Loop, set after measurement is switched on	x dBm
		All other patterns, set after measurement is switched on	UE transmits according to the received TPC commands, UL target power ignored.
	TPC = Manual UL Target Power = x dBm	Closed Loop	x dBm
		All other patterns	UE transmits according to the received TPC commands, UL target power ignored.
Spectrum7)	UL Target Power = x dBm	Closed Loop, set before measurement is switched on	Closed loop suspended during the measurement, replaced by *Alternating 0,1* pattern. UE transmits in a fixed power range (x dBm ± 1 power step).
		Closed Loop, set after measurement is switched on	**Attention:** Closed loop at off-carrier frequencies causes fast UE power changes.
		All other patterns	UE transmits according to the received TPC commands, UL target power ignored.

---

6) See ***Error! Reference source not found.*** on p. **Error! Bookmark not defined.** ff.
7) See ***Error! Reference source not found.*** on p. **Error! Bookmark not defined.** ff.

Measurement	Measurement Settings	TPC Pattern Type	UE Power
All other measurements	UL Target Power = x dBm	Closed Loop	x dBm
		All other patterns	UE transmits according to the received TPC commands, UL target power ignored.

WCDMA Uplink Power Control

In CDMA networks, control of the UE transmit power is essential to ensure stable transmission and an efficient radio resource management within the system. Generally speaking, an output power of the UE transmitter that is too low decreases the coverage area while an excess output power may cause interference to other channels or systems. Both effects decrease the system capacity.

The Node B transmits a series of Transmit Power Control (TPC) commands on the DL channel. The UE receives the TPC commands and adjusts its transmit power according to one of the following algorithms for uplink power control (see standard 3GPP TS 25.214):

Algorithm 1 One TPC command is received in each slot. If the received TPC command is equal to 1 (0), then the power control parameter TPC_cmd for that slot is +1 (–1). This implies that the UE transmitter output power changes after each slot.

Algorithm 2 One TPC command is received in each slot. The slots are grouped into sets of 5 slots, aligned to the frame boundaries, so that there is no overlap between different sets of 5 slots. If the received TPC command is equal to 1 (0) in all 5 slots of a set, then the power control parameter TPC_cmd for the 5th slot is +1 (–1). Otherwise TPC_cmd for the 5th slot is 0. This implies that the UE transmitter output power only changes if the same TPC command is received in a complete set of 5 slots.

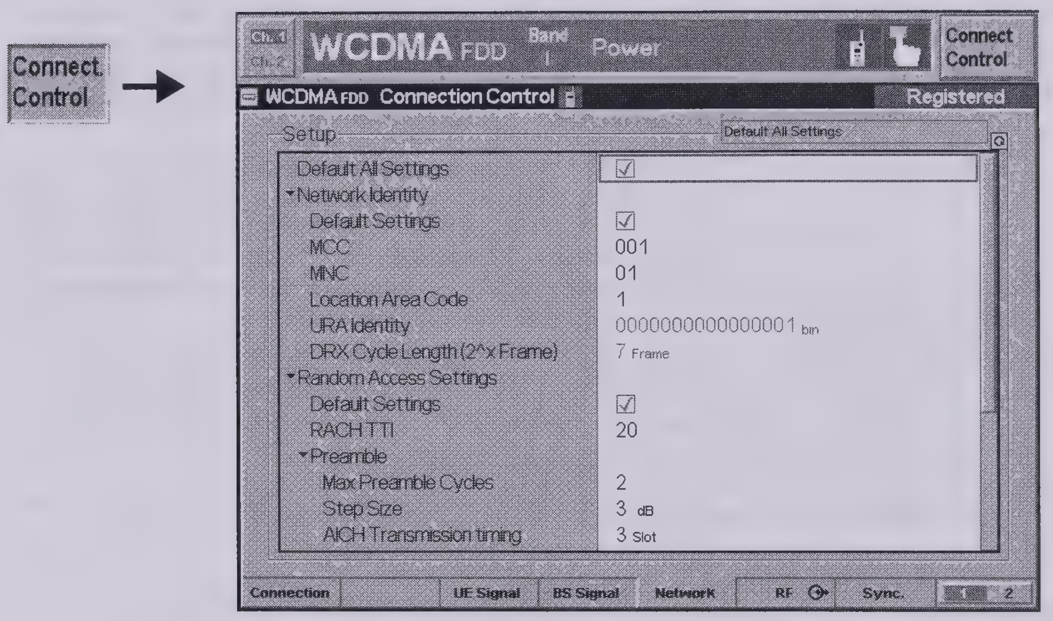
For both algorithms, the UE transmitter output power changes by TPC_cmd times the *TPC Step Size* of 1 dB or 2 dB.

Network Parameters (Connection Control – Network)

The *Network* tab defines various parameters that the CMU, representing the UTRAN, reports to the UE.

- The *Test Loop* to be set at the UE. This network parameter can also be defined in the *Connection* tab; see section *Connection – State Signal Off* on p. 4.145.
- Various code numbers defining the *Network Identity*
- Parameters for *Random Access* of the UE to the network
- Check of UE properties during registration *(Requested UE Data).*

Some settings may not be available in all signalling states of the CMU. Exact description is provided in the remote control command description in Chapter 6.



Default All Settings ☑
▾Network Identity
  Default Settings ☑
  MCC 001
  MNC 01
  Location Area Code 1
  URA Identity 0000000000000001 bin
  DRX Cycle Length (2^x Frame) 7 Frame
▾Random Access Settings
  Default Settings ☑
  RACH TTI 20
  ▾Preamble
    Max Preamble Cycles 2
    Step Size 3 dB
    AICH Transmission timing 3 Slot

Fig. 4-81 Connection Control – Network parameters

The following settings are not provided in the *Connection* tab.

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Network* tab (the default values are quoted in the command description in Chapter 6). Additional default switches are provided for the individual section in the *Network* tab.

Remote control

```
DEFault:NETWork
DEFault:NETWork:IDENtity
DEFault:NETWork:RAC
```

Network Identity The *Network Identity* section contains parameters of the radio network that the CMU transfers to the UE under test.

MCC	3-digit Mobile Country Code, set to 001 by default
MNC	Mobile Network Code. A two or three-digit MNC can be set. If *Two-Digit MNC* is selected while a three-digit MNC is active, then the MNC is reset to the default value 01.
Location Area Code	LAC in the range 0 hex to F hex
URA Identity	UTRAN Registration Area (URA) identity in the range 0000 0000 0000 0000 bin to 1111 1111 1111 1111 bin

Remote control

```
CONFigure:NETWork:IDENtity:MCC  <MCC>
CONFigure:NETWork:IDENtity:MNC  <MNC>
CONFigure:NETWork:IDENtity:MNC:DIGits TWO | THR
CONFigure:NETWork:IDENtity:LAC  <LAC>
CONFigure:NETWork:IDENtity:URA  <URA>
```

Random Access Settings

The *Random Access Settings* section sets the parameters required for initiating a physical random access procedure of the UE (TS 25.214).

Random access procedures are used when establishing the layer 1 communication between the UE and UTRAN, i.e. when the UE attempts a registration towards the CMU or a connection. In brief they consist of randomly selecting access slots and transmitting RACH preambles at increasing power until the Node B sends an ACK/NACK on the AICH or until the maximum number of preambles within one cycle is exceeded. After receiving an ACK the UE transmits a message, otherwise the ramping cycle is repeated. For an explanation of the parameters see *Fig. 4-82 below*.

DRX Cycle L.	Length of the Discontinuous Reception (DRX) cycle that the UE uses in idle mode in order to reduce power consumption (see standard TS 25.304). The DRX cycle length is in the range between 2^6 frames and 2^9 frames: When DRX is used the UE needs only to monitor one Page Indicator (PI) in one Paging Occasion per DRX cycle.
RACH TTI	Length of the RACH Transmission Time Interval in ms. In FDD mode, a RACH may employ either 10 or 20 ms TTI.
Max. Preamble Cycles	Maximum number of times the preamble cycle is repeated

The following parameters define a single preamble cycle:

Step Size	Transmit power difference between two consecutive preambles
AICH Transmission Timing	Minimum time delay between two consecutive preambles; see footnote of *Fig. 4-82 below*
Max. Retransmission	Maximum number of preambles to be transmitted before a single preamble cycle is terminated
RACH Msg. Part Power Offset	Power difference between the last preamble transmitted and the RACH message part

Remote control

```
CONFigure:NETWork:RAC:DRXCycle  <DRX_Cycle>
CONFigure:NETWork:RAC:TTI
CONFigure:NETWork:RAC:PREamble:MCYCles
CONFigure:NETWork:RAC:PREamble:SSIZe
CONFigure:NETWork:RAC:PREamble:TAICh
CONFigure:NETWork:RAC:PREamble:MRETurn
CONFigure:NETWork:RAC:PREamble:POFFset
```

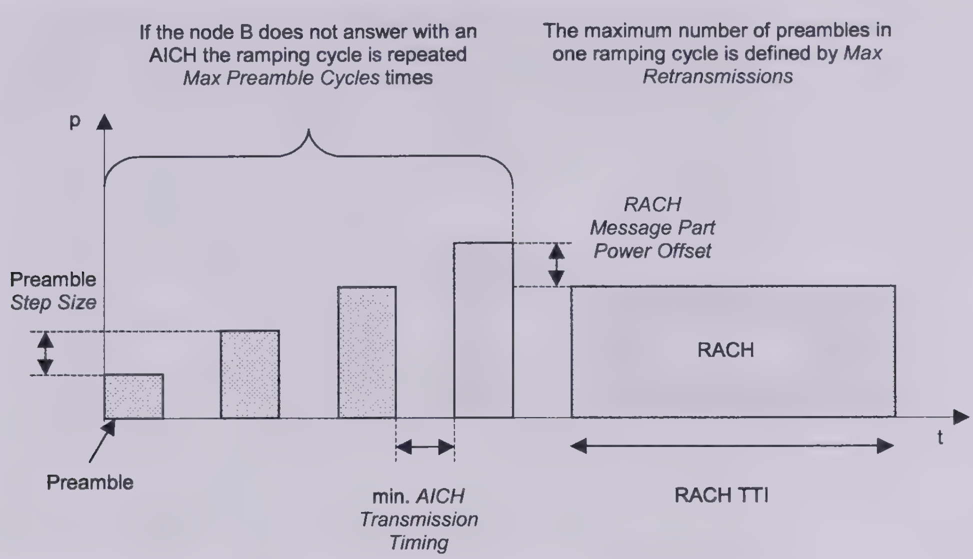

If the node B does not answer with an AICH the ramping cycle is repeated *Max Preamble Cycles* times
The maximum number of preambles in one ramping cycle is defined by *Max Retransmissions*
p
RACH Message Part Power Offset
Preamble *Step Size*
RACH
t
Preamble
min. *AICH Transmission Timing*
RACH TTI

Fig. 4-82 Connection Control – random access settings[8]

Requested UE Data

The *Requested UE Data* section defines which UE data are requested and transferred to the CMU during registration and how the registration is performed.

In general, disabling the check of UE data accelerates the registration process. Besides, it can be useful to test UEs under development that fail to provide their data.

UE Radio Access Capability	Enable *(On)* or disable *(Off)* request of radio access capability. This information is displayed in the *Connection* tab; see p. 4.151.
IMEI	Enable *(On)* or disable *(Off)* request of the International Mobile station Equipment Identity. This information is displayed in the *Connection* tab; see p. 4.151 ff.
Authentication	Enable *(On)* or disable *(Off)* the authentication procedure during registration. Authentication requires a test USIM. An appropriate 3GPP UICC/USIM can be obtained from Rohde & Schwarz (R&S CRT-Z3, stock no. 1139.1005.02). If authentication is enabled, the *Security* mode can be activated in addition.
Security	Enable *(On)* or disable *(Off)* the security mode during authentication. With enabled security mode, the UE performs an integrity check. Security is always disabled if authentication is switched off.
Keep RRC Connection	Keep *(On)* or release *(Off)* a RRC (Radio Resource Control) connection established during registration. After the RRC is released, the UE is in idle mode where the transmitter is switched off and *Off Power* measurements can be performed. On the other hand, a released RRC connection must be re-established in order to set up a connection, so activating *Keep RRC Connection* accelerates the subsequent connection setup.
Handover Activation Time	Delay time (number of WCDMA frames with a duration of 10 ms) before the UE, after receiving a HANDOVER

---

[8] In the random access procedure, only the minimum delay between two consecutive preambles is a predefined value. The actual time delay is not necessarily constant as it is selected by the UE; see TS 25.214.

COMMAND from the CMU, initiates the handover by releasing the WCDMA connection and attempting a connection to the GSM cell (see also section *Handover to GSM (Connection Control – Handover)* on p. 4.158 ff. This parameter can be changed to remedy a failure of a WCDMA to GSM inter cell handover:

- If the handover fails because the mobile no longer sees the (previous) WCDMA cell, it is recommended to reduce the HO activation time.
- If the handover fails because the mobile can not detect the (new) GSM cell, it is recommended to extend the HO activation time.

Note: *If registration fails, the UE capabilities may not be in accordance with the Requested UE Data settings, in particular with the authentication and security mode. Registration can fail if authentication or security is disabled but the UE expects/requires an authentication or security procedure. It can also fail if authentication or security is enabled but not supported by the UE.*

Remote control

```
CONFigure:NETWork:REQuest:ACAPability ON | OFF
CONFigure:NETWork:REQuest:IMEI ON | OFF
CONFigure:NETWork:REQuest:AUTHenticat ON | OFF
CONFigure:NETWork:REQuest:SECurity ON | OFF
CONFigure:NETWork:REQuest:RRCC ON | OFF
CONFigure:NETWork:REQuest:HACTime <Frames>
```

RF Connectors (Connection Control – AF/RF)

The *AF/RF* ☞ tab selects the connectors for RF signals. This includes the setting of

- The RF input and output at the CMU (RF Output, RF Input)
- An external attenuation at the connectors (Ext. Att. Output, Ext. Att. Input)
- The input source of the CMU speech encoder and the output destination of its speech decoder

If the *Audio Generator and Analyzer* (option CMU-B41) is not fitted, the speech codec (option CMU-B52) is connected to the 9-pole *SPEECH* (handset) connector on the CMU front panel, see chapter 8 of the CMU operating manual. The *Speech Encoder* and *Speech Decoder* settings are not available.

Connect. Control →

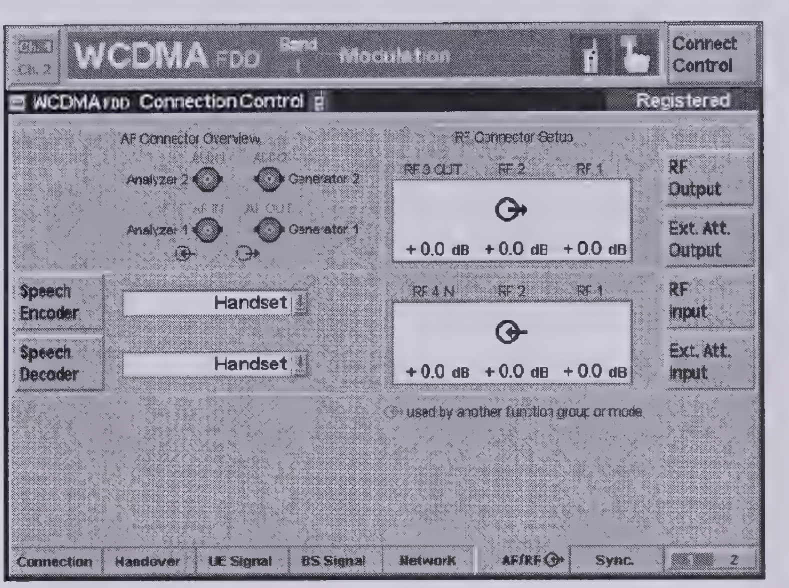

WCDMA FDD
Band 1
Modulation
Connect Control
WCDMA FDD Connection Control
Registered
AF Connector Overview
AUX 2
AUX 2
Analyzer 2
Generator 2
AF IN
AF OUT
Analyzer 1
Generator 1
RF Connector Setup
RF 3 OUT
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
RF 4 IN
RF 2
RF 1
+0.0 dB
+0.0 dB
+0.0 dB
used by another function group or mode
Speech Encoder
Handset
Speech Decoder
Handset
RF Output
Ext. Att. Output
RF Input
Ext. Att. Input
Connection
Handover
UE Signal
BS Signal
Network
AF/RF
Sync.
2

Fig. 4-83 Connection Control – AF/RF connectors

With the exception of the *Speech Encoder* and *Speech Decoder* routing, all functions of this menu are described in section *RF Connectors (Connection Control – RF Connectors)* on p. 4.132 ff.

Speech Encoder

The *Speech Encoder* softkey selects the input source for the CMU speech encoder (option CMU-B52). The following two input sources are available:

Generator	Use the audio generator signal which is also fed to the *AF OUT* connector on the CMU front panel
Handset	Use the signal of the 9-pole *SPEECH* (handset) connector on the CMU front panel

Remote control
`ROUTe:SPENcoder[:INPut] HANDset | GENerator`

Speech Decoder

The *Speech Decoder* softkey selects the output destination for the CMU speech decoder (option CMU-B52). The following output destinations are available:

Handset	Route speech decoder output to the 9-pole *SPEECH* (handset) connector on the CMU front panel
Analyzer	Route speech decoder output to audio analyzer. The standard analyzer input socket *AF IN* is disabled *(Off).*
Analyzer 2	Route speech decoder output to secondary audio analyzer. The standard secondary analyzer input socket *AUX 1* is disabled *(Off).*
Analyzer Both	Route speech decoder output to primary audio analyzer. The standard primary and secondary analyzer input sockets *AF IN* and *AUX 1* are disabled *(Off).*

The primary and secondary audio circuits are described in detail in chapter 4 and 6 of the CMU200/300 operating manual.

Remote control
`ROUTe:SPDecoder[:OUTPut] HANDset | ANALyzer | ANA2 | ABOTh`

AF Connector Overview

The *AF Connector Overview* shows the destination of the input signals fed in via AF IN and AUX 1 and the signal sources for the two audio output connectors AF OUT and AUX 2. The routing of input and output signals does not depend on the *Speech Encoder* settings but is a function of the *Speech Decoder* output destination. In the default configuration *(Speech Decoder = Handset),* the connectors AF IN and AF OUT are used as input and output for the primary audio circuit (Analyzer 1, Generator 1). AUX 1 and AUX 2 are used as input and output for the secondary audio circuit (Analyzer 2, Generator 2). If the *Speech Decoder* output is routed to one of the Analyzers, it replaces the external audio input signal. The corresponding input connector is disabled *(Off)*.

Reference Frequency (Connection Control – Sync.)

The *Sync.* tab determines the reference signal for synchronization. This includes

- The selection of internal or external reference frequency
- The output mode for the reference frequency (RF REF OUT 2)

The functions of this menu are described in section *Reference Frequency (Connection Control – Sync.)* on p. 4.134 ff.

Remote control

```
CONFigure:SYNChronize:FREQuency:REFerence:MODE
      INTernal | EXTernal
CONFigure:SYNChronize:FREQuency:REFerence <Frequency>
SOURce:DM:CLOCk:STATe ON | OFF
SOURce:DM:CLOCk:FREQuency <Frequency>
```

Trigger (Connection Control – Trigger)

The *Trigger* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2a* again switches back to the first group of tabs described above.

The functions of this menu are described on page 4.136 f. The *Internal* trigger source in *Non Signalling* mode is replaced by a *Signalling* trigger with analogous properties:

- The trigger signal is derived from the *BS Signal*, taking into account the 3GPP standard DL/UL timing offset of 1024 chip periods.
- The beginning of the measured UL slot is searched in a symmetric range around the expected time.
- A frame trigger, a slot trigger and a TPC trigger signal is generated.

The left half of the menu shows the pin assignment of the AUX 3 connector with pin 8 as an input for the external trigger signal.

I/Q-IF Interface (Connection Control – I/Q-IF)

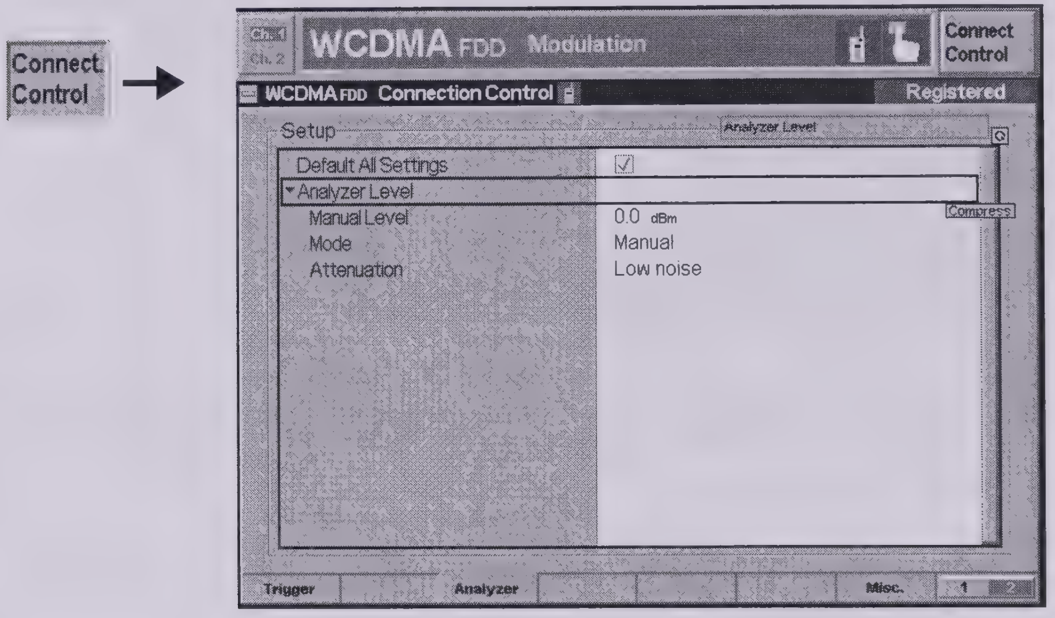
The *I/Q-IF* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2* again switches back to the first group of tabs described above.

The *I/Q-IF* tab configures the signal paths for I/Q and IF signals. The functions of this menu are described in section *I/Q-IF Interface (Connection Control – I/Q-IF)* on p. 4.139 ff.

Analyzer Settings (Connection Control – Analyzer)

The *UE Signal* tab configures the RF input path of the CMU. This comprises:

- The maximum expected input level, the way it is defined and the RF attenuation *(Analyzer Level)*


Connect. Control
Ch. 1
Ch. 2
WCDMA FDD Modulation
Connect Control
WCDMA FDD Connection Control
Registered
Setup
Analyzer Level
Compress
Trigger
Analyzer
Misc.
1
2

Default All Settings ☑
Analyzer Level
Manual Level 0.0 dBm
Mode Manual
Attenuation Low noise

Fig. 4-84 Connection Control – Analyzer

Default Settings The *Default All Settings* switch assigns default values to all settings in the *Analyzer* tab (the default values are quoted in the command description in Chapter 6).

Remote control
`DEFault:LEVel`

Analyzer Level The Analyzer Level section configures the RF input path of the CMU. The parameters are described in section *Analyzer Settings (Connection Control – Analyzer)* on p. 4.105 ff.

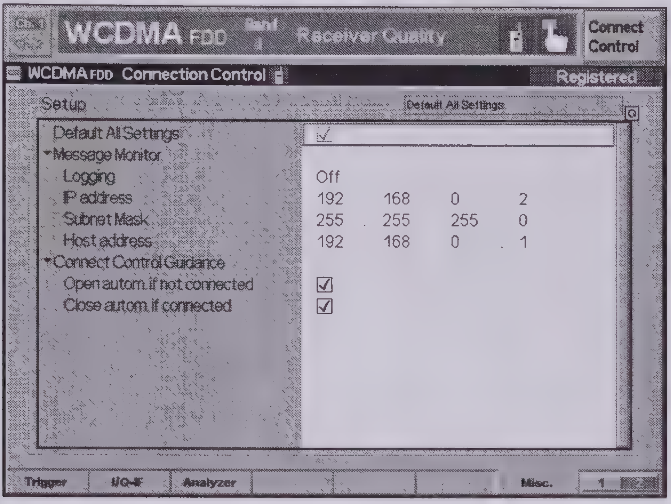
*R*emote control
```
[SENSe:]LEVel:MAXimum <Level>
[SENSe:]LEVel:MODE  MANual | AUTomatic
[SENSe:]LEVel:ATTenuation NORMal | LNOise | LDIStortion
```

Display Control (Connection Control – Misc)

The *Misc.* tab is part of the second group of tabs in the *Connection Control* menu. It is accessible after pressing the *1 / 2* toggle hotkey once. Pressing *1 / 2* again switches back to the first group of tabs described above.

The *Misc.* tab defines in what instances the *Connection Control* popup menu is automatically opened or closed *(Connect. Control Guidance)* ans sets the address information for the *Message Analyzer*.

Connect. Control →


WCDMA FDD
Band 1
Receiver Quality
Connect Control
WCDMA FDD Connection Control
Registered
Setup
Default All Settings
Trigger
I/Q-IF
Analyzer
Misc.
1

Default All Settings ☑
Message Monitor
Logging Off
IP address 192 . 168 . 0 . 2
Subnet Mask 255 . 255 . 255 . 0
Host address 192 . 168 . 0 . 1
Connect Control Guidance
Open autom. if not connected ☑
Close autom. if connected ☑

Fig. 4-85 Connection Control – Misc

Default Settings	The *Default All Settings* switch sets all parameters of the *Misc* tab to their default values (see command description in Chapter 6).
Remote control	–

Connect. Control Guidance Defines in what instances the *Connection Control* popup menu is automatically opened or closed:

Open autom. if not connected

In the *Open automatically* mode, the *Connection Control* menu is automatically opened each time the WCDMA function group is accessed in *Signalling* test mode, each time a measurement menu is opened while the DUT is not connected and each time a connection is lost. Otherwise the menu must be opened manually.

Close autom. if connected

In the *Close automatically* mode, the *Connection Control* menu is automatically closed as soon as the CMU reaches the *Connected/Call Established* state. Otherwise the menu must be closed manually.

Remote control No command; screen configuration only.

Message Analyzer

The *Message Analyzer* section defines the address information necessary for connecting the *WCDMA Message Analyzer* installed on a PC to the CMU. The connection can be established through Ethernet (dedicated or non-dedicated connection), so it is necessary to use unique addresses assigned by the network.

The *WCDMA Message Analyzer* is an optional accessory for the CDMA200 options (option R&S CMU-Z46) to capture, interpret, and display the WCDMA downlink and uplink messages exchanged between a CMU200 and a UE. For more information refer to the separate R&S CMU-Z46 operating manual, stock no. 1159.0956.12.

Logging	Enables *(On)* or disables message logging. Both actions cause a connection to a DUT to be released and the CMU to enter the *Signal On* state. With disabled logging, no messages are stored to the active message log file. As an alternative, logging can be stopped or paused in the *Message Recorder* module of R&S CMU-Z46.
IP Address	IP address of the CMU
Subnet Mask	Subnet Mask address of the CMU
Host address	IP address of the PC

Remote Control

```
CONFigure:MMONitor:LOGGing ON | OFF
CONFigure:MMONitor:IPADdress
<IP Address 1>, <IP Address 2>, <IP Address 3>, <IP Address 4>
CONFigure:MMONitor:SMASk
<Subnet Mask 1>, <Subnet Mask 2>, <Subnet Mask 3>, <Subnet Mask 4>
CONFigure:MMONitor:HOST
<Host 1>, <Host 2>, <Host 3>, <Host 4>
```

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Measurement Control 5.3

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- Measurement Statistics 5.4
- Specifying Limits 5.6

Status Reporting System 5.7

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5 Remote Control – Basics

This chapter gives a survey of the basic features and concepts of WCDMA remote control commands. Remote control can be described in terms analogous to the ones used in Chapter 3 for the classification of measurement and configuration menus. In the following, we will particularly point out the similarities and differences between manual and remote control.

Structure of WCDMA Function Group

Chapter 6 of this manual lists gives a description of all WCDMA remote control commands, including their parameters, as well as the default values and ranges of all numerical parameters.

Function group and test modes The WCDMA UE function group provides the two test modes *Signalling* and *Non Signalling*. Many commands in the two test modes have the same syntax.

Addressing The CMU uses extended addressing: The instrument is assigned a primary address while the WCDMA function groups are identified via secondary addresses. In principle, this concept allows the same remote commands and program parts to be used in WCDMA and in function groups and test modes from other networks:

```
ibwrt(h_WCDMA19UEFDD_NSig, "[:SENSe]:LEVel:MODE AUTomatic")
ibwrt(h_GSM900MS_Sig,  "[:SENSe]:LEVel:MODE AUTomatic")
ibwrt(h_GSM1800MS_NSig,  "[:SENSe]:LEVel:MODE AUTomatic")
```

provided that the variables `h_WCDMA19UEFDD_NSig` etc. have been appropriately defined, see program examples in chapter 7 of the CMU operating manual.

The remote control commands for first `(SYST:COMM:GPIB:ADDR)` and secondary `(SYST:REM:ADDR:SEC)` addressing are described in the CMU operating manual. The `SYST:REM:ADDR:SEC` command uses the following names to address the WCDMA function groups:

WCDMA19UEFDD_Nsig, *WCDMA19UEFDD_Sig*

Order of commands The commands are arranged to form groups belonging to the same measurement or to the same type of configurations. These command groups are identified by the second-level keyword (as in `POWer`). Applications belonging to a measurement group (see chapter 5 of the CMU operating manual) are identified by the lower-level keywords of each command (as in `MODulation:EVMagnitude:QPSK`). Chapter 6 is organized as follows:

General configurations in Non Signalling mode:

Second-level keywords `LEVEL, RFANalyzer, RFGenerator, UECode, INPut, OUTPut, CORRection:LOSS, DM:CLOCk, TRIGger`

Measurement groups, provides in Non Signalling mode only:

`POWer:XSLot, MODulation:IQANalyzer`

Common command and measurement groups (identical or almost identical in Non Signalling and Signalling mode:

`MMEMory, SYSTem:OPTions, SYSTem:RESet, IQIF, POWer` (including the applications `MAXimum, MINimum, OFF, ILTPc)`, `MODulation:OVERview` (including the applications `QPSK` and `WCDMa:DPCH)`, `MODulation:EVMagnitude` (including the applications `QPSK` and `WCDMa:DPCH)`, `MODulation:PERRor` (including the applications `QPSK` and `WCDMa:DPCH)`, `MODulation:MERRor` (including the applications `QPSK` and `WCDMa:DPCH)`, `SPECtrum:MFILter`, `SPECtrum:MFFT`, `SPECtrum:EMASk`, `MFFT CDPower` (including the applications `:AUTomatic`, `:RAUTomatic`, `:MANual` and `:RMANual)`, `RXQuality`.

WCDMA Signalling:

General configurations and signalling (`LEVel`, `TRIGger`, `SIGNalling`, `UESignal`, `BSSignal`, `NETWork`, `INPut`, `OUTPut`, `CORRection:LOSS`, `DM:CLOCk`).

The structure of chapter 6 differs from chapter 4 *(Functions and their Application)* where the measurements are presented first and configurations pertaining to the whole function group and test mode are reported at the end of each section.

The menu of the graphical user interface corresponding to a group of commands is quoted at the beginning of each section. Alphabetical lists of all commands are annexed to chapter 6.

SCPI Conformity

In view of the particular requirements of WCDMA measurements not all commands could be taken from the SCPI standard. However, the syntax and structure of all commands is based on SCPI rules. For a detailed description of the SCPI standard refer to chapter 5 of the CMU operating manual.

SCPI confirmed and SPCI approved commands are explicitly marked throughout chapter 6.

Remote Control

All commands may be used for control of the CMU via GPIB interface or serial (RS-232) interface.

Measurement Control

The commands in the measurement groups quoted above (`POWer...`, `MODulation...`, `SPECtrum...`, `CDPower...`, `RXQuality...`) have an analogous structure and syntax. The measurements are controlled according to the common concepts outlined in Chapter 5 of the CMU operating manual. The following sections show how the general concepts are applied to WCDMA measurements.

Measurement Groups

The measurement groups are referred to as *measurement objects* (keyword <meas_obj>) in remote control. For WCDMA measurements, the following measurement objects are defined:

Table 5-1 List of measurement objects

Measurement Object	**Applications**	**Functionality**
`POWer`	`MAXimum`	Peak and RMS-averaged transmitter output power of the UE that transmits at maximum power, including limit check and statistical evaluation.
	`MINimum`	Peak and RMS-averaged transmitter output power of the UE that transmits at minimum power, including limit check and statistical evaluation.
	`OFF`	Peak and RMS-averaged transmitter output power of the UE that is set to its transmit OFF power state, including limit check and statistical evaluation.
	`XSLot`	Fast measurement of RMS-averaged transmitter output power of the UE in up to 100 consecutive slots (non Signalling only).
	`ILTPc`	Test of inner loop Transmit Power Control (TPC) of the UE including limit check.
`MODulation...`	`OVERview`	Scalar parameters characterizing the modulation accuracy of the UE transmitter generating a single QPSK-modulated signal (`QPSK`) or a multiple WCDMA signal (`WCDMa:DPCH`), including limit check and statistical evaluation.
	`EVMagnitude`	Error vector magnitude of a single QPSK-modulated signal (`QPSK`) or a multiple WCDMA signal (`WCDMa:DPCH`) plotted over one slot, including limit check and statistical evaluation.
	`MERRor`	Magnitude error of a single QPSK-modulated signal (`QPSK`) or a multiple WCDMA signal (`WCDMa:DPCH`) plotted over one slot, including limit check and statistical evaluation.
	`PERRor`	Phase error of a single QPSK-modulated signal (`QPSK`) or a multiple WCDMA signal (`WCDMa:DPCH`) plotted over one slot, including limit check and statistical evaluation.
	`IQANalyzer`	Analysis of the UE signal in the I/Q plane.
`SPECtrum`	`MFILter`	Adjacent Channel Leakage power Ratio (ACLR) at definite off-carrier frequencies, including limit check and statistical evaluation.
	`MFFT`	ACLR as a continuous function of the frequency, calculated by means of a Fast Fourier Transform. A filtered, continuous ACLR and the Occupied Bandwidth (OBW) is derived from the FFT curve. A limit check and a statistical evaluation is provided in addition.
	`EMASk`	Spectrum emissions in the frequency range between 2.5 MHz and 12.5 MHz from the carrier frequency measured with different Gaussian filters including limit check.

Measurement Object	Applications	Functionality
`CDPower`	`AUTomatic` `RAUTomatic`	Code domain power (`AUTOmatic`) and Code Domain Rho Factor (`RAUTomatic`) in all code domain channels contributing to the uplink WCDMA signal.
	`MANual` `RMANual`	Code domain power (`MANual`) and Code Domain Rho Factor (`RAUTomatic`) in all physical channels contributing to the uplink WCDMA signal. A limit check and a statistical evaluation is provided in addition.
`RXQuality`	–	Bit Error Rate, Block Error Rate, and Data Block Error Rate in synchronized mode (with options CMU-K76 and CMU-B68/U68).

The measurement objects in *Table 5-1* are complemented by groups of commands used to retrieve results that are automatically provided by the mobile station (e.g. the UE Radio Access Capabilities reported by the mobile phone). These command groups do not represent real measurement objects; they consist of queries only and are called pseudo measurement objects. For a complete overview of all commands, see the lists of remote control commands at the end of chapter 6.

Measurement Statistics

In the WCDMA network, the (modulated) RF signal is divided into periodic slots serving as basic evaluation periods for the measurement and for the calculation of statistical results.

Together with the *Statistic Count*, the *Repetition Mode* defines how many evaluation periods are measured if the measurement is not stopped explicitly (measurement control commands `STOP...`, `ABORT...`) or by a limit failure. With remote control the three repetition modes *Single Shot, Continuous* and *Counting* are available (*Counting* is not available in manual control, see chapter 3).

In `MODulation` and `CDPower` measurements, different traces corresponding to the result in the current evaluation period, the maximum, minimum, extreme value, or average over a set of evaluation periods (bursts) are determined. These results can be queried independently.

Table 5-2 Repetition mode in remote control

Setting	Description	Command
Statistic Count	Integer number of evaluation periods forming one statistics cycle. An evaluation period is equal to a slot. The statistic count is set together with the measured quantity.	`CONFigure:<meas_obj>:CONTrol:STATistics 1 ... 1000 | NONE` (`<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality;` see *Table 5-1* on p. 5.3)
Repetition mode Single Shot	The measurement is stopped after one statistics cycle.	`CONFigure:<meas_obj>:CONTrol:REPetition` **`SINGleshot`**`, <StopCondition>, <Stepmode>` (`<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality;` see *Table 5-1* on p. 5.3
Continuous	The measurement is continued until stopped explicitly or by a limit failure. Average results are calculated according to the rules given in chapter 3.	`CONFigure:<meas_obj>:CONTrol:REPetition` **`CONTinuous`**`, <StopCondition>, <Stepmode>` (`<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality;` see *Table 5-1* on p. 5.3)

Setting	**Description**	**Command**
Counting	Repeated single shot measurement with configured statistics cycles.	`CONFigure:<meas_obj>:CONTrol:REPetition` **`1 ... 10000`**`, <StopCondition>, <Stepmode>` (`<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality;` see *Table 5-1* on p. 5.3) A counting measurement with 1 evaluation period is equivalent to a single shot measurement..

Measurement Curves	The specifiers `CURRent, MAXimum, MINimum, MMAX,` and `AVERage` denote the traces for the current evaluation period, the maximum, minimum, extreme value, or average of a set of evaluation periods. They correspond to the *Display Mode* set in the measurement configuration menus.
	In general several traces are evaluated during the measurement. They are selected via the specifiers used as last keywords in the `READ..., FETCh...` or `SAMPle...` queries.
		Measurement results:
		`READ:ARRay:MODulation:EVMagnitude...<disp>?`
		`READ:SUBarrays:MODulation:EVM...<disp>?`
		`...`
		`<disp> = :CURRent | :AVERage |`
		`:MMAX | MINimum`
		Limit matching:
		`CALCULATE:ARRay:CDPower...<disp>:`
		`MATChing:LIMit?`
		`....`
		`<disp> = :CURRent | :AVERage |`
		`:MAXimum | MINimum`
		Analogous commands for other `MODulation` and `CDPower` applications and for `<meas_obj> = SPECtrum:MFFT`

Specifying Limits

The following table gives an overview of the types of limits and possible results of the limit check.

Table 5-3 Limits and limit check

Type	**Description**	**Command**

Scalar limits	Limit values for a single (scalar) measured quantity. Depending on the measured quantity, either an upper limit or upper and lower limits can be defined.	`CONFigure:<meas_obj>:<disp>:LIMit [SCALar]:<Spec.>:VALue`
		`<disp> = :CMMax | :AVERage | :CMAX` for display modes Current & Max./Min. or Average or Current & Maximum
		`<meas_obj> = POWer... | MODulation... | SPECtrum..., CDPower..., RXQuality`
		`<Spec.> = ASYMmetric:UPPer | ASYMmetric:LOWer | SYMMetric[:COMBined]` for upper limits, lower limits, or combined upper and lower limits.

Limit lines	For the spectrum emission measurement a tolerance template (emission mask) can be defined.	`CONFigure:<meas_obj>:<disp>:LIMit:LINE :<Spec.> <Limit>`
		`<meas_obj> = SPECtrum:EMASk`
		`<disp> = :CMax | :AVERage` for display modes Current & Max./Min. or Average
		`<Spec.>` denotes an array of keywords specifying the upper or lower limit line in a definite channel.

Limit check	All scalar limits belonging to the same measurement group are read out together with the command on the right side.	`CALCulate[:SCALar]:<meas_obj.> ...:MATChing:LIMit?`
	Possible results of the scalar limit check are listed on the right side. Further messages assessing, e.g., the power ramp or the result of the BER test in general, may be issued in particular cases (see detailed command description in chapter 6).	`NMAU` not matching, underflow `NMAL` not matching, overflow `INV` measured value invalid `OK` no limit failure

	In some instances the command to calculate the limit check depends on the statistics settings (see section *Measurement Statistics* on page 5.4).	`CALCULATE:ARRay:<meas_obj>: <disp>:MATChing:LIMit? ....`
		`<meas_obj> = CDPower:MANual or CDPower:RMANual`
		where `<disp> = :CURRent | :AVERage | :MAXimum | :MINimum`

Status Reporting System

A general description of SCPI status registers and of the status reporting system is given in chapter 5 of the CMU operating manual. The present section is devoted to the particular features concerning WCDMA measurements.

The CMU offers 30 independent `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-registers (<nr>=1 ... 15) which are implemented in hierarchical form. The bits of the 30 `STATus:OPERation` registers are set only after the registers are assigned to a function group and measurement mode.

In the `CONDition` part, the `STATus:OPERation` register contains information on which actions the instrument is being executing or, in the EVENt part, information on which actions the instrument has executed since the last readout. All fife parts of the registers can be read using one of the commands of the subsystem `STATus:OPERation:SUM1|2:CMU<nr>:...`

WCDMA tests comprise the two signalling modes *Non Signalling* and *Signalling* so that two secondary addresses are used. The bit assignment in the corresponding two status registers is identical.

Table 5-4 Meaning of the bits used in the `STATus:OPERation:CMU:SUM1|2:CMU<nr>` sub-register assigned to the WCDMA function groups

Bit-No.	**Meaning**	**Symbol in `STAT:OPER:SYMB...`**
2	**Synchronization Lost** This bit is set during a *Receiver Quality* measurement if the UL signal from the WCDMA UE can not be received with the expected timing. In this case it may be necessary to adjust the *DL/UL Timing.*	**SLOS**
10	**Trigger Not Found** This bit is set during a *Power* measurement (applications *Maximum Power, Minimum Power, Off Power, Power vs. Slot* or *Inner Loop TPC)* if the CMU was not able to detect the external trigger signal.	**TRNF**
11	**RF Input Overdriven** This bit is set if the RF input level exceeds the *Max. Level* defined in the *Analyzer* tab of the *Connection Control* menu.	**RFIO**
12	**RF Input Underdriven** This bit is set if the RF input level falls below the measurement range given by the *Max. Level* defined in the *Analyzer* tab of the *Connection Control* menu..	**RFIU**
13	**Scrambling code or slot format does not match input signal** This bit is set if the CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the *Scrambling Code* or the *Slot Format* set in the UE Code tab of the Connection Control menu. The error may occur in all measurements with channel decoding, e.g. in the *Modulation...WCDMA* applications or in a *Code Domain Power* measurement. If the error occurs, the measurement results are very likely to be wrong.	**SCPW**

Special Terms and Notation

Below we list some particular features in the syntax of the WCDMA commands. The general description of the SCPI command syntax can be found in chapter 5 of the CMU operating manual, section *"Structure and Syntax of Device Messages"*.

Description of commands

The commands are arranged in tables. From top to bottom, the table rows contain the following entries:

1. Complete command syntax including the parameter list and a short description of the command
2. List and description of the parameters with their default values and the units
3. Detailed description of the command, required firmware version

To make it clear how the commands are structured and related to each other, groups of analogous commands are described in common tables.

Order of commands

The commands are arranged according to their function specified by the keyword in the second level or in the second/third level combined. Lower-level keywords define the command in more detail. This means that commands with the same second-level, third-level etc. keywords are generally grouped together in the same sections.

Example: `CONFigure:POWer:MAXimum:CONTrol:REPetition`

Commands with the keyword *`POWer`* in the second level belong to the power measurement. The keyword in the third level denotes the application (maximum output power of the UE transmitter). The keywords in the fourth and fifth level indicate that the command controls the repetition mode of the power measurement.

Scalar results and arrays

To limit the number of remote control commands, scalar results are always measured together and output in lists. Arrays (e.g. the traces for `MODulation` measurements) are output as lists of values separated by commas; it is possible to retrieve either the whole list (see commands `READ:ARRay...` etc.) or the values located in a number of subranges that are part of the total measurement range (see commands `READ:SUBarrays...;` the subarrays are defined via `CONFigure:SUBarrays...`).

Parameters

Setting commands are usually supplemented by a parameter or a list of several parameters. Parameters either provide alternative options (setting a or setting b or setting c ..., see special character "|"), or they form a list separated by commas (setting x,y).

<Par_Name>

In the command tables and lists, parameters are generally described by a name (literal) written in angle brackets (<>). This literal merely serves as a parameter description; in an application program it must be replaced by one of the possible settings reported in the detailed parameter description.

Example: `CONFigure:POWer:OFF:CONTrol <Mode>, <Statistics>,...`

with

```
<Mode>       = SCALar | ARRay
<Statistics> = 1 ... 10000 | NONE
...
```

possible command syntax: `CONF:POW:OFF:CONT SCAL,NONE,..`

NAN	NAN (not a number) is generally used to represent missing data, e.g. if a portion of a trace has not been acquired yet. It is also returned after invalid mathematical operations such as division by zero. As defined in the SCPI standard, NAN is represented as 9.91 E 37.
INV	INV (invalid) is returned if a limit check is performed without defining the appropriate tolerance values.
Upper / lower case	Upper/lower case characters characterize the long and short form of the keywords in a command. The short form consists of all upper-case characters, the long form of all upper case plus all lower case characters. On the CMU, either the short form or the long form are allowed; mixed forms will generally not be recognized. Note that the instrument itself does not distinguish upper case and lower case characters.

Special characters

| A vertical stroke in the parameter list characterizes alternative parameter settings. Only one of the parameters separated by | must be selected.

Example: The following command has two alternative settings:

```
TRIGger:SEQuence:DEFault ON | OFF
```

[ ] *Key words* in square brackets can be omitted when composing the command header (see chapter 5 of the CMU manual, section "Structure of a Command"). The complete command must be recognized by the instrument for reasons of compatibility with the SCPI standard.

Parameters in square brackets are optional as well. They may be entered in the command or omitted.

{ } Braces or curly brackets enclose one or more parameters that may be included zero or more times.

<nr> This symbol denotes a numeric suffix, e.g. an enumeration index for input and output connectors.

Lists of commands

Command: The *Command* column of the table contains all remote control commands arranged according to their function (configurations or measurement objects). Within a section, the commands are listed in alphabetical order.

Parameters: The *Parameter* column lists the parameters of the commands.

Remarks: The *Remarks* column gives additional information about the commands which

- Have no query form *(no query)*
- Have only a query form *(query only)*

Can be used both as setting commands and as queries (*with query*, this applies to all commands belonging to none of the two preceding categories)

Alphabetical Lists Chapter 6 concludes with alphabetical command lists for both test modes.

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6 Remote Control – Commands

In the following, all remote-control commands for the WCDMA UE test function groups will be presented in tabular form with their parameters and the ranges of values. The chapter is organized in analogy to the reference part for manual operation (Chapter 4):

- The measurement modes *Non Signalling* and *Signalling* are presented separately.
- Within the measurement modes, general configurations *(Connection Control)* and the individual measurement groups are described separately.
- Command and measurement groups that are identical or almost identical in both test modes *(POWer...,SPECtrum..., IQIF*, symbolic status register evaluation etc.) are presented in a separate section between the two test modes.

General notes on remote control in the WDCMA UE test function groups can be found in Chapter 5. An introduction to remote control according to the IEEE 488.2/SCPI standard is given in Chapter 5 of the CMU200/300 operating manual.

Connection Control (Non Signalling)

The remote-control commands in this section configure the measurements in the WCDMA function group globally, i.e., they provide settings that are valid for all measurements in the function group. They correspond to the settings in the popup menu of the softkey *Connection Control* located to the right of the headline of each main menu.

Subsystem LEVel (Input Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *Analyzer* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE *<Mode>*				Input level – Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual | **AUTomatic**	Manual setting Automatic setting corresponding to average power of signal applied	MANual	–	V3.00
Description of command				
This command defines how the maximum input level is set.				

[SENSe:]LEVel:MAXimum *<Level>*				Max. Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–40 dBm to +53 dBm	Maximum input level for RF 1	+30.0	dBm	V3.00
–54 dBm to +39 dBm	Maximum input level for RF 2	+30.0	dBm	
–77 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	
Description of command				
This command defines the maximum expected input level. The value range depends on the RF input used and the external attenuation set (see `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]` command).				

[SENSe:]LEVel:ATTenuation <*Mode*> Attenuation

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
NORMal | **LNOise |** **LDIStortion**	Mixer level in normal range Low noise (mixer level 10 dB higher than in normal setting) Low distortion (mixer level 10 dB lower than in normal setting)	LNOise	–	V3.00

Description of command

This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing). The setting is valid for all measurement groups. Exception: In `SPECtrum`, an additional mode can be set up via `CONFigure:SPECtrum:CONTrol:HDYNamic`.

DEFault:LEVel Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem RFANalyzer (Analyzed Input Signals)

The subsystem *RFANalyzer* configures the RF analyzer, i.e., it specifies which type of RF signals can be analyzed. It corresponds to the panel *Analyzer Settings* in the *Analyzer* tab of the popup menu *Connection Control*.

[SENSe:]RFANalyzer:FREQuency <*Number*> RF Channel

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
15 MHz to 2 700 MHz (see also data sheet)	Input frequency (in multiples of 200 kHz)	1922.4	MHz	V3.00

Description of command

This command defines the frequency of the RF signal analyzed. With the command `[SENSe:]RFANalyzer:FREQuency:UNIT`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the 3GPP specifications.

Note: *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:RFAN:FREQ CH` and their channel numbers.*

UNIT:RFANalyzer:FREQuency *<Unit>*				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit Channel number (UARFCN)	MHz	MHz	V3.00
Description of command				
This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an UARFCN. Frequency units must be used to select input signals that are outside the designated channel range. ***Note:*** *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:RFAN:FREQ CH` *and their channel numbers.*				

[SENSe:]RFANalyzer:FOFFset *<FreqOffset>*				Frequency Offset
<FreqOffset>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Offset for channel frequency	0	kHz	V3.00
Description of command				
This command defines an offset for the RF analyzer frequency set with the command `[SENSe:]RFANalyzer:FREQuency <Number>`. The offset frequency must be in multiples of 1 Hz.				

Subsystem RFGenerator (Generator control)

The subsystem *RFGenerator* configures the RF signals generated by the CMU. It corresponds to the softkey *RF Generator* in the *Generator* tab in the popup menu *Connection Control*.

INITiate:RFGenerator	Start RF generator, reserve resources	⇒ *RUN*
ABORt:RFGenerator	Switch off RF generator, release resources	⇒ *OFF*
Description of command		FW vers.
These commands have no query form. They start and stop the RF generator, setting it to the status indicated in the top right column.		V3.05

FETCh:RFGenerator:STATus?				Generator Status
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | RUN | ERR	Generator switched off (`ABORt` or `*RST`) Running (`INITiate`) Switched off (could not be started)	OFF	–	V3.05
Description of command				
This command is always a query. It returns the current generator status.				

DEFault:RFGenerator				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the `RFGenerator` subsystem (including the commands in the following sub-sections) to default values. The setting *OFF* results in an error message. If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Channel-Independent Generator Settings

The following commands define channel-independent properties of the RF signal. It corresponds to the *Generator Settings* section in the *Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:FREQuency <*Number*> — RF Channel

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
10 MHz to 2 700.0 MHz (see also data sheet)	Generator frequency (in multiples of 200 kHz)	2112.4	MHz	V3.05

Description of command

This command defines the frequency of the RF signal generated. The default frequency unit can be changed with the command `UNIT:RFGenerator:FREQuency`, and channel numbers (UARFCNs) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies meets the 3GPP specification.

Note: *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:RFG:FREQ CH` *and their channel numbers.*

UNIT:RFGenerator:FREQuency <*Unit*> — Frequency Unit

<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit | Channel number	MHz	MHz	V3.05

Description of command

This command defines whether the frequency of the RF signal generated is specified in frequency units or as a channel number.

Note: *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:RFG:FREQ CH` *and their channel numbers.*

SOURce:RFGenerator:FOFFset <*FrequencyOffset*> — Frequency Offset

<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Frequency offset	0	kHz	V3.05

Description of command

This command defines an offset for the RF generator frequency set with the command `SOURce:RFGenerator:FREQuency`. The offset frequency must be in multiples of 1 Hz.

SOURce:RFGenerator:SCODe:PRIMary <*Code*> — Primary Scrambling Code

<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H000 to #H1FF	Primary scrambling code	#H0	–	V3.05

Description of command

This command defines the primary scrambling code for the downlink RF generator signal. The range of scrambling code numbers corresponds to 0 to 511 decimal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.

SOURce:RFGenerator:SCODe:SECondary <*Code*>				Secondary Scrambling Code
<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V3.05

Description of command
This command defines the secondary scrambling code for the downlink RF generator signal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.

SOURce:RFGenerator:LREFerence <*Reference*>				Level Reference
<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
PCPich | **OPOWer**	Relative to P-CPICH level Relative to Output Channel Power	PCPich	–	V3.15

Description of command	Sig. State
This command qualifies whether all channel power are expressed relative to the (absolute) P-CPICH level (`SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or to the total Output Channel Power (`SOURce:RFGenerator:OPOWer`).	all

SOURce:RFGenerator:OPOWer <*Level*>				Output Channel Power
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–147.1 dBm to –37.1 dBm	Output ch. power if RF 1 is used	–51.6	dBm	V3.15
–147.1 dBm to –20.1 dBm	Output ch. power if RF 2 is used	–51.6	dBm	
–100.1 dBm to +2.9 dBm	O. ch. power if RF 3 OUT is used	–51.6	dBm	

Description of command	Sig. State
This command sets the absolute output channel power of the RF signal. This level is the reference for all other physical and synchronization channel levels and can not be switched off.	all

SOURce:RFGenerator:OCNS <*Level*>				OCNS
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **OFF**	Relative OCNS level OCNS switched off	OFF	dB	V3.15

Description of command	Sig. State
This command sets the level of the Orthogonal Channel Noise Simulator relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`). The setting is ignored if the channel powers are expressed relative to the total output channel power (`SOURce:RFGenerator:LREFerence OPOWer`).	all

SOURce:RFGenerator:PHYSical:LEVel All Physical Channel Levels
<P-CPICH_abs> | <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPDCH>, <Power Offset>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm* **–147.0 dBm to –20.0 dBm*** **–100.0 dBm to +3.0 dBm***	Absolute P-CPICH level if RF 1 is used Absolute P-CPICH level if RF 2 is used Abs. P-CPICH level if RF 3 OUT is used	–96.3 –96.3 –96.3	dBm dBm dBm	V3.50
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.50
<P-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-SCH level (level reference = P-CPICH) P-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<S-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	S-SCH level (level reference = P-CPICH) S-SCH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<P-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-CCPCH level (level ref. = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.50
<PICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	PICH level (level ref. = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<DPDCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	V3.50
<Power Offset>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.50

Description of command

This command sets all physical channel level at once. The levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the `SOURce:RFGenerator:LREFerence` setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

*) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `SOURce:RFGenerator:OPOWer)`. If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

Subsystem RFGenerator:SCHannel (Synchronization Channels)

The subsystem *RFGenerator...:LEVel* defines the level of the individual channels contributing to the RF signal. It corresponds to the *Synchronization Channels* section in the *RF Generator* tab of the popup menu *Connection Control*.

Note: *The command `SOURce:RFGenerator:LREFerence` sets all physical channel levels at once. Using this command is preferable because it allows the instrument to check the consistence of the entire level set and avoid conflicting settings during the program sequence.*

SOURce:RFGenerator:SCHannel:LEVel:PCPich <*Level_abs*> | <*Level_rel*> P-CPICH Level

<*Level_abs*>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–96.3	dBm	V3.05
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–96.3	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–96.3	dBm	
<*Level_rel*>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.15

Description of command

This command sets the absolute level of the Primary Common Pilot ChannelChannel in absolute units or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.. The absoluteis level is the reference for all other physical and synchronization channel levels and can not be switched off.

*) The reported level ranges quoted above correspond to the total output power ranges at the three RF output connectors (see command `SOURce:RFGenerator:OPOWer`). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

SOURce:RFGenerator:SCHannel:LEVel:PSCH <*Level*> P-SCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	V3.05
–30 dB to 0 dB	P-SCH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Primary Synchronization Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.

SOURce:RFGenerator:SCHannel:LEVel:SSCH <*Level*> S-SCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	V3.05
–30 dB to 0 dB	S-SCH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Secondary Synchronization Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.

Subsystem RFGenerator:DBCHannel (Dedicated & Broadcast Channels)

The subsystem *RFGenerator:DBCHannel* defines the dedicated and broadcast channel settings. It corresponds to the *Dedicated & Broadcast Channel* section in the *Generator* tab of the popup menu *Connection Control*.

Note: *The command `SOURce:RFGenerator:LREFerence` sets all physical channel levels at once. Using this command is preferable because it allows the instrument to check the consistence of the entire level set and avoid errors during the program sequence.*

SOURce:RFGenerator:DBCHannel:LEVel:PCCPch <*Level*> P-CCPCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB	P-CCPCH level	–2.0	dB	V3.05
–35 dB to +15 dB |	P-CCPCH level (level reference = P-CPICH)	–2.0	dB	V3.05
–30 dB to 0 dB	P-CCPCH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Primary Common Control Physical Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.

SOURce:RFGenerator:DBCHannel:LEVel:DPDCh <*Level*> DPDCH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	DPDCH level	–7.0	dB	V3.05
OFF	DPDCH channel switched off			
–35 dB to +15 dB |	DPDCH level (level reference = P-CPICH)	–7.0	dB	V3.05
–30 dB to 0 dB	DPDCH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Dedicated Physical Data Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.

SOURce:RFGenerator:DBCHannel:LEVel:PICH <*Level*> PICH Level

<*Level*>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB	PICH level	–5.0	dB	V3.07
–35 dB to +15 dB |	PICH level (level reference = P-CPICH)	–5.0	dB	V3.07
–30 dB to 0 dB	PICH level (level reference = total channel power)	–	dB	V3.15

Description of command

This command sets the level of the Page Indicator Channel relative to the P-CPICH level (see command `SOURce:RFGenerator:SCHannel:LEVel:PCPich`) or relative to the total channel power, depending on the `SOURce:RFGenerator:LREFerence` setting.

SOURce:RFGenerator:DBCHannel:DPDCh:CODE <*Code*> DPDCH Channelization Code

<*Code*>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 511	DPDCH Channelization Code	2	–	V3.05

Description of command

This command assigns a channelization code to the Dedicated Physical Data Channel.

SOURce:RFGenerator:DBCHannel:DPDCh:MODE <*Mode*> Dedicated Channel Mode

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
TGPP |	3GPP DL reference channel	TGPP	–	V3.05
PHYS	Physical channel			

Description of command

This command defines whether the dedicated channel is configured as a downlink reference channel according to 3GPP TS 25.101 (see section *Subsystem RFGenerator:RCHannel (Reference Channel)* on p. 6.9 ff.) or as a physical channel (see section *Subsystem RFGenerator:PCHannel (Physical Channel)* on p. 6.10 ff.).

SOURce:RFGenerator:DBCHannel:PICH:CODE <*Code*>				PICH Channelization Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 255	PICH Channelization Code	2	–	V3.07
Description of command				
This command assigns a channelization code to the Page Indicator Channel.				

SOURce:RFGenerator:DBCHannel:POFFset <*Level*>				Power Offset
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.05
Description of command				
This command sets the ratio of DPCCH to DPDCH power.				

SOURce:RFGenerator:DBCHannel:TSTate <*Enable*>				TFCI State
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	TFCI bits present or omitted	ON	–	V3.05
Description of command				
This command defines whether or not the downlink physical channel contains any Transport Format Combination Indicator (TFCI) bits.				

DEFault:RFGenerator:DBCHannel				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:RCHannel (Reference Channel)

The subsystem *RFGenerator:RCHannel* defines the reference channel. It corresponds to the *3GPP DL Reference Channel* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:RCHannel:TYPE <*Bit_Rate*>				Reference Channel Type
<Bit_Rate>	Description of parameters	Def. value	Def. unit	FW vers.
12.2 kbps | 64 kbps | 144 kbps | 384 kbps	Information bit rate	12.2	kbps	V3.05
Description of command				
This command sets the information bit rate of the 3GPP DL Reference Measurement Channel.				

SOURce:RFGenerator:RCHannel:SDTCh ***<Sequence>***				Channel Data Source DTCH
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	PR9	–	V3.05
Description of command				
This command defines the bit pattern transmitted on the Dedicated Traffic Channel.				

SOURce:RFGenerator:RCHannel:SDCCh? ***<Sequence>***				Channel Data Source DCCH
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
PREDefined	Fixed, predefined bit pattern	PRED	–	V3.05
Description of command				
This command is always a query and returns the bit pattern transmitted on the Dedicated Control Channel.				

SOURce:RFGenerator:RCHannel:TBITs ***<Enable>***				TFCI Bits
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 3	TFCI bits	0	–	V3.05
Description of command				
This command defines the Transport Format Combination Indicator (TFCI) bits to be transmitted on the downlink physical channel.				

DEFault:RFGenerator:RCHannel				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:PCHannel (Physical Channel)

The subsystem *RFGenerator:PCHannel* defines the physical channel. It corresponds to the *DL Physical Channel* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:PCHannel:SFORmat ***<Number>***				Slot Format
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 16	Slot format	11	–	V3.05
Description of command				
This command defines the slot format number for the downlink physical channel.				

SOURce:RFGenerator:PCHannel:DSOurce <*Sequence*>				Data Source
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 | **ALL1 |** **ALT |** **PR9 | PR11 | PR13 | PR15**	Bit sequence consisting of zeros Bit sequence consisting of ones 010101... bit sequence Pseudo-random bit sequences	ALT	–	V3.05
Description of command				
This command defines the bit pattern transmitted on the downlink physical channel.				

DEFault:RFGenerator:PCHannel				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Subsystem RFGenerator:TPC (Transmit Power Control)

The subsystem *RFGenerator:TPC* defines the Transmit Power Control information transmitted on the DPCH. It corresponds to the *TPC Settings* section in the *RF Generator* tab of the popup menu *Connection Control*.

SOURce:RFGenerator:TPC:PSET <*Setup*>				TPC Pattern Setup
<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 | **SET2 |** **SET3 |** **SET4 |** **SET5**	Setup 1 Setup 1 Setup 1 Setup 1 Setup 1	SET1	–	V3.40
Description of command				Sig. State
This command the TPC pattern setup to be used. All setups no. 1 to 5 are defined by the *TPC Pattern Type* (`SOURce:RFGenerator:TPC:PTYPe<nr>`) and the single *Pattern* (`SOURce:RFGenerator:TPC:PATTern<nr>`).				all

SOURce:RFGenerator:TPC:PTYPe<nr> *<Profile>* Pattern Type

<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ALT **ALL0 |** **ALL1 |** **CPAT |** **SPA0 |** **SPA1 |** **SPAL**	Alternating 0,1 Bit sequence consisting of zeros Bit sequence consisting of ones Continuous pattern Single pattern + All 0 Single pattern + All 1 Single pattern + Alternating	see below	–	V3.05, V3.40 (suffix)

Description of command

This command defines the bit pattern transmitted on the Dedicated Traffic Channel. The single pattern is defined via `SOURce:RFGenerator:TPC:PATTern`; see below. The numeric suffix <nr> = 1 to 5 discriminates between the five different test setups; see `SOURce:RFGenerator:TPC:PSET`.

The default pattern type depends on the test setup:

<nr>	1	2	3	4	5
Pattern Type	ALT	CPAT	SPA0	SPA1	SPAL

SOURce:RFGenerator:TPC:PATTern<nr> *<Pattern>* Pattern

<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
"<3 bit to 22 bit sequence>"	Single TPC pattern	<nr> = 1: “01010101010101010101” <nr> = 1: “11111000001111100000” <nr> = 1: “11111111111111111111” <nr> = 1: “00000000000000000000” <nr> = 1: “11111111110000000000”	–	V3.07, V3.40 (suffix)

Description of command

This command defines the single bit pattern that is used to construct the TPC profile; see command `SOURce:RFGenerator:TPC:PTYPe` above. The numeric suffix <nr> = 1 to 5 discriminates between the five different test setups; see `SOURce:RFGenerator:TPC:PSET`.

SOURce:RFGenerator:TPC:RPATtern ON Repeat Pattern

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON	Send single TPC pattern	–	–	V3.10

Description of command	Sig. State
This command has no query form. It causes a single TPC pattern (defined via `CONFigure:RFGenerator:TPC:PATTern`) to be sent at the next allowed frame boundary; see description in Chapter 4. The command is executed only if one of the pattern types `SPA0`, `SPA1` or `SPAL` is selected (command `CONFigure:RFGenerator:TPC:PTYPe`); otherwise the CMU generates the SCPI error no. –200, “Execution Error”.	all

DEFault:RFGenerator:TPC Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem UECode (UE Code Channels)

The subsystem *UECode* defines the properties of the uplink WCDMA signal from the UE that the CMU is able to analyze. The subsystem corresponds to the *UE Code* tab in the popup menu *Connection Control.*

CONFigure:UECode:AMODe *<Mode>* Analysis Mode

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
WOOFfset | **WIOFfset**	Measurement without origin offset Measurement with origin offset	WIOF	–	V3.00

Description of command

This command defines whether a possible origin offset is included in the measurement results (WIOFfset) or subtracted out (WOOFfset).

Subsystem UECode:DPCH (Dedicated Physical Channel)

The subsystem *UECode:DPCH* configures the Dedicated Physical Channel (DPCH) and the conditions for the *WCDMA Modulation* and the *Code Domain Power* measurements. The subsystem corresponds to the *DPCH WCDMA Settings* section in the *UE Code* tab of the popup menu *Connection Control.*

CONFigure:UECode:DPCH:SFORmat *<Number>* Slot Format

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 5	Slot format number of the UE signal	0	–	V3.05

Description of command

This command defines the slot format number of the UL DPCCH. Many properties of the DPCCH are given in terms of the slot format number; see table in chapter 4.

CONFigure:UECode:DPCH:SCODe *<Code>* Scrambling Code

<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to FFFFFF (hex)	Scrambling long code number	0	–	V3.00

Description of command

This command defines the number of the long code that is used to scramble the WCDMA signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.

CONFigure:UECode:DPCH:SYMode *<Mode>* Sync. Mode

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ASL | **SYNC**	*All Slots* sync. mode *Synchronous* mode	ASL	–	V3.00

Description of command

This command defines whether the slot number is to be deduced from the pilot bits in the captured signal *(ASL)* or assumed to be defined by the `CONFigure:UECode: DPCH:SNUMber` command *(SYNC).*

CONFigure:UECode:DPCH:SNUMber *<Slot_No>* Measurement Slot Number

<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14	Measurement slot no. within the frame	0	–	V3.00

Description of command

This command defines the measured slot number of the captured signal within the 10 ms frame. The value is taken into account in the `CONFigure:UECode:DPCH:SYMode SYNC` setting.

CONFigure:UECode:DPCH:CMODe *<Mode>* Correlation Mode

<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 | **1**	DPCCH DPCCH + DPDCH	0	–	V3.07

Description of command

This command defines which DPCH contributions are used for the correlation analysis.

DEFault:UECode:DPCH Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem UECode:DPDCh (Dedicated Physical Data Channel)

The subsystem *UECode:DPDCh* configures the Dedicated Physical Data Channels (DPDCH) that contribute to the WCDMA signal. The subsystem corresponds to the *DPDCH Settings* section in the *UE Code* tab of the popup menu *Connection Control*.

CONFigure:UECode:DPDCh:AUTO:SRATe *<Rate>* DPDCH Symbol Rate

<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
15 | 30 | 60 | 120 | 240 | 480 | 960	Symbol rate of the DPDCH	960	ksps	V3.00

Description of command

This command defines the symbol rate of the DPDCH. The setting is taken into account if one of the `CDPower:AUTomatic` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `AUTomatic`.

CONFigure:UECode:DPDCh:AUTO:THReshold *<THReshold>* Threshold

<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
–25 dB to +10 dB	Power threshold for each DPDCH_n	–3	dB	V3.00

Description of command

This command defines the minimum signal strength of each DPDCH in the WCDMA signal to be detected in the automatic channelization code search. The setting is taken into account if one of the `CDPower:AUTomatic` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH: CONT:CCM`) is set to `AUTomatic`.

CONFigure:UECode:DPDCh:MANual:MSIGnal *<Channels>* Multiple Settings

<Channels>	Description of parameters	Def. value	Def. unit	FW vers.
0 |	DPCCH only	1	–	V3.00
1 |	DPCCH + DPDCH1			
2 |	DPCCH + DPDCH1,2			
3 |	DPCCH + DPDCH1,2,3			
4 |	DPCCH + DPDCH1,2,3,4			
5 |	DPCCH + DPDCH1,2,3,4,5			
6	DPCCH + DPDCH1,2,3,4,5,6			

Description of command

This command defines which physical channels that contribute to the WCDMA signal analyzed. The setting is taken into account if one of the `CDPower:MANual` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `MANual`.

CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode *<Rate>,<Code>* Symbol Rate/C. Code

<Rate>,<Code> for query	Description of parameters	Def. value	Def. unit	
960,1 |	DPDCH$_1$ at 960 ksps	960,1	ksps,–	
480,2 |	...			
240,4 |				
120,8 |				
60,16 |				
30,32 |				
15,64	DPDCH$_1$ at 15 ksps			

<Rate>,<Code> for setting	Description of parameters	Def. value	Def. unit	FW vers.
960,1 |	DPDCH$_1$ at 960 ksps	960,1	ksps,–	V3.00
480,1 |	...			
240,1 |				
120,1 |				
60,1 |				
30,1 |				
15,1	DPDCH$_1$ at 15 ksps			

Description of command

This command sets the symbol rate for the DPDCH$_1$ contributing to the multiple WCDMA signal. The CMU deduces the channelization code from the symbol rate according to 3GPP specifications. The setting is taken into account if one of the `CDPower:MANual` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `MANual`.

Note: *If this command is used to set the symbol rate, the <Code> parameter 1 must be entered, otherwise the CMU will return an error message. However, the <Code> parameter is ignored and the CMU will use the channelization code according to 3GPP specifications. The query always returns the actual symbol rate and channelization code of the DPDCH$_1$, even if the analyzed signal contains several DPDCHs (see command `CONFigure:UECode:DPDCh:MANual:MSIGnal` above).*

DEFault:UECode:DPDCh Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Inputs and Outputs (External Attenuation)

The commands in this section configure the input and output connectors. They correspond to the tab *RF* ⊛ in the popup menu *Connection Control*.

INPut[:STATe] *<State>* RF Input

<State>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 | **RF2 |** **RF4**	Connector RF 1 used as input Connector RF 2 used as input Connector RF 4 IN used as input	RF2	–	V3.00

Description of command

This command determines the connector to be used for RF input signals. The bidirectional connectors RF 1 and RF 2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`).

Only one input and one output may be active at the same time, a new RF input setting supersedes the previous one.

OUTPut[:STATe] *<State>* RF Output

<State>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 | **RF2 |** **RF3**	Connector RF 1 used as output Connector RF 2 used as output Connector RF 3 OUT used as output	RF2	–	V3.00

Description of command

This command determines the connector to be used for RF output signals. The bidirectional connectors RF 1 and RF 2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`).

Only one input and one output may be active at the same time, a new RF output setting supersedes the previous one.

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation>*
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation>* Ext. Att. Input

<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at the input <nr>, where <nr> = 1,2,4	0.0	dB	V3.00

Description of command

This command assigns an external attenuation value to the inputs of the instrument *(RF 1, RF 2, RF 4 IN)*.

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>*
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>* Ext. Att. Output

<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +90 dB	Value for external attenuation at output <nr>, where <nr> = 1,2,3	0.0	dB	V3.00

Description of command

This command assigns an external attenuation value to the outputs of the instrument *(RF 1, RF 2, RF 3 OUT)*.

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connection Control*.

SOURce:DM:CLOCk:STATe *<Mode>* REF OUT 2 on/off

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switch on/off system clock	OFF	–	V3.00

Description of command

This command switches the system clock specific to the network at the *REF OUT 2* connector on or off.

SOURce:DM:CLOCk:FREQuency <Frequency> REF OUT 2

<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
0.960 MHz to 30.720 MHz	System clock frequency	30.720	MHz	V3.00

Description of command

This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values:

0.960	0.991	1.024	1.059	1.097	1.138	1.181	1.229	1.280	1.335
1.396	1.463	1.536	1.617	1.706	1.807	1.920	2.028	2.194	2.363
2.560	2.793	3.072	3.143	3.840	4.388	5.120	6.144	7.680	10.240
15.360	30.720								

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* determines the trigger mode. It corresponds to the table section *Trigger* in the *Analyzer* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce *<Source>* Source

<Source>	Description of parameters	Def. value	Def. unit	FW vers.
FRUN | **EXTern |** **INTern |** **IFPower**	Trigger by measured timing of the analyzed input signal External trigger signal via AUX3 Internal trigger signal provided by RF generator Narrow-band IF power trigger	FRUN	–	V3.00

Description of command

This command selects the trigger mode. The *INTernal* trigger signal is available with option CMU-K66, *WCDMA (3GPP/FDD, DL) Generator,* and for FW ≥ V3.05 only.

TRIGger[:SEQuence]:DELay *<Slot_Delay>* , *<Delay_Offset>* Slot Delay, Delay Offset

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14,	No. of slots between trigger time and measurement	0	(slots)	–
–2559.75 to +2559.75	No of chips between trigger time and measurement (in multiples of ¼ chip periods)	0	(chips)	V3.05

Description of command

This command defines a delay time (integer number of slots plus additional delay offset) between the trigger time and the start of the measurement. The settings are ignored for free-run measurements (see command `TRIGger[:SEQuence]:SOURce`).

TRIGger[:SEQuence]:THReshold:IFPower *<Threshold>*				Level – IF Power
<Threshold>	Parameter description	Def. value	Default unit	FW vers.
–47 dB to 0 dB	IF power threshold	–26	dB	V3.50
Command description				
This command sets the IF signal level at which the measurement is triggered. The IF power threshold is defined relative to the maximum RF input level; see `[SENSe:]LEVel:MAXimum`. The setting has effect for trigger source `IFPower` only (see `TRIG:SEQ:SOUR`).				

TRIGger[:SEQuence]:SLOPe *<Slope>*				Slope
<Slope>	Parameter description	Def. value	Default unit	FW vers.
POSitive | **NEGative**	Rising edge Falling edge	POS	–	V3.50
Command description				
This command qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements (see `TRIG:SEQ:SOUR`).				

DEFault:TRIGger[:SEQuence]				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				

Measurement Groups (Non Signalling only)

The measurement groups in this section are provided in *Non Signalling* mode only.

POWer:XSLot

The subsystem *POWer:XSLot* controls the *Power vs. Slot* measurement. It corresponds to the measurement menu *Power*, application *P/Slot Table*, and the sections in the popup menu *Power Configuration* that are related to the *P/Slot Table* application.

Note: *The `POWer:XSLot` measurement must be carried out with an external trigger (`TRIGger[:SEQuence]:SOURce EXTern`) or with an internal frame trigger.*

INITiate:POWer:XSLot	Start new measurement	⇒ *RUN*
ABORt:POWer:XSLot	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:XSLot	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:XSLot	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.07

CONFigure:POWer:XSLot:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.07
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see chapter 5 of CMU manual).

FETCh[:SCALar]:POWer:XSLot:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.07
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
1 to 1000 |	Counter for current statistics cycle			
NONE	No counting mode set	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapters 3 and 5 of CMU manual).

Subsystem POWer:XSLot:CONTrol

CONFigure:POWer:XSLot:CONTrol:REPetition *<Repetition>,<StopCondition>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (*continuous*, until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single measurement *(single shot*, `until Status = RDY`)			
1 to 1000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.07

Description of command

This command determines the number of statistics cycles and the stepping mode for the measurement.

Note: *For READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

CONFigure:POWer:XSLot:CONTrol:PMWidth *<Slots>* Power Mea. Width

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
0.25 | 0.50 | 1.00	Power measurement width	0.25	(slots)	V3.07

Description of command

This command defines the the measurement time for a single measurement step. A power measurement width of 1 slot, where the CMU measures and averages over the whole useful part of the slot, is available only if the step width set via `CONFigure:POWer:XSLot:CONTrol:SWIDth` is larger than 1 slot.

CONFigure:POWer:XSLot:CONTrol:SCOunt *<Slots>* Step Count

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 100	Number of slots measured per statistics cycle	100	(slots)	V3.07

Description of command

This command defines the number of slots measured in one statistics cycle.

CONFigure:POWer:XSLot:CONTrol:SWIDth *<Slots>* Step Width

<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 15	Step width of the measurement	1	(slots)	V3.07

Description of command

This command defines the number of slots skipped between two consecutive measurements. With a step width of 1 (slot), each slot is measured.

CONFigure:POWer:XSLot:CONTrol:SDELay <*Slots*>				Step Delay
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 100	Trigger step delay	0	(slots)	V3.07
Description of command				
This command defines a delay time (number of slots) between the trigger time and the start of the measurement. The step delay is added to the *Slot Delay* and the *Delay Offset* defined via `TRIGger[:SEQuence]:DELay <Slot_Delay>, <Delay_Offset>`.				

DEFault:POWer:XSLot:CONTrol <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values The parameters differ from the default values (partially or totally)	ON	–	V3.07
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				

Subsystem POWer:XSLot?

The subsystem *POWer:XSLot* measures power versus slot and returns the results. The subsystem corresponds to the measurement menu *P/Slot Table*.

READ[:SCALar]:POWer:XSLot:CURRent? **FETCh[:SCALar]:POWer:XSLot:CURRent?** **SAMPle[:SCALar]:POWer:XSLot:CURRent?**				P/Slot Graph Results Start single shot measurement and return results Read out measurement results (unsynchronized) Read out measurement results (synchronized)
Returned Values	Description of parameters	Def. value	Def. unit	FW vers.
–100 dBm to 100 dBm, **...** **–100 dBm to 100 dBm**	Avg. power in slot 0, ..., Avg. power in slot Slot 99[*)]	NAN, ..., NAN	dBm, ..., dBm	V3.07
Description of command				
These commands are always queries. They start a measurement and return all measurement results. The returned list contains the average burst power of the mobile phone in up to 100 consecutive timeslots. [*)] The total number of slots measured and the number of output values can be limited by means of the `CONFigure:POWer:XSLot:CONTrol:SCOunt` command.				

MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* measures the I and Q amplitudes of the received QPSK or WCDMA signal as a function of time. The subsystem corresponds to the measurement menu *Modulation*, applications *I/Q Analyzer QPSK* and *I/Q Analyzer WCDMA*, and the sections in the popup menu *Modulation Configuration* that are related to the *I/Q Analyzer...* applications.

Control of Measurement – Subsystem MODulation:IQANalyzer

The subsystem *MODulation:IQANalyzer* controls the measurement. It corresponds to the softkeys *I/Q Analyzer QPSK* and *I/Q Analyzer WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:IQANalyzer:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:IQANalyzer:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:IQANalyzer:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:IQANalyzer:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:IQANalyzer:WCDMa:DPCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:IQANalyzer:WCDMa:DPCH	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:IQANalyzer:WCDMa:DPCH	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:IQANalyzer:WCDMa:DPCH	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the measurement, setting it to the status indicated in the top right column.	V3.15

CONFigure:MODulation:IQANalyzer:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.15
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:IQANalyzer:QPSK:STATus? Measurement Status
FETCh:MODulation:IQANalyzer:WCDMa:DPCH:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.15
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE		NONE	–	

Description of command
These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *I/Q Analyzer* applications.

Subsystem MODulation:IQANalyzer:QPSK:CONTrol

The subsystem *MODulation:IQANalyzer...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay**	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARR	–	V3.15

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.15

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.15

Description of command

This command selects the time interval to be measured (QPSK signals only). A small measurement length accelerates the measurement and causes the output arrays to be truncated.

CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:ROTation <*Enable*> Rotation

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 | **45**	No rotation (0°) Rotation by 45°	0	–	V3.15

Description of command

This command qualifies whether the constellation and vector diagrams are rotated by 45°. A rotation has an impact on the I/Q imbalance. Any parameter except 0 or 45 causes a "Numeric data error".

DEFault:MODulation:IQANalyzer:QPSK:CONTrol <*Enable*>
DEFault:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SUBarrays:...

The subsystem *SUBarrays:...* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:IQANalyzer:QPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
0 to 10239 | **0 to 2559**	First sample in current range (depending on measurement length)	0	–	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 10240 | **0 to 2560**	Number of samples in current range (depending on measurement length)	2560 10240	–	V3.15

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:IQANalyzer...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1/4 chip period (oversampling factor 4).

The subranges may overlap but must be within the total range of the *I/Q Analyzer* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter of a slot (see command `CONFigure:MODulation:IQANalyzer:QPSK: CONTrol:MLENgth`), then the start value must be in the range between sample no. 0 and sample no. 2559, the maximum number of samples is 2560.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:IQANalyzer:QPSK

The subsystem *MODulation:IQANalyzer:...?* measures and returns the I and Q amplitudes as a function of time. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *I/Q Analyzer QPSK* and *I/Q Analyzer WCDMA.*

READ[:SCALar]:MODulation:IQANalyzer:QPSK? Scalar Results:
READ[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:IQANalyzer:QPSK?
FETCh[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:IQANalyzer:QPSK?
SAMPle[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Error Vector Magnitude (RMS),	0.0 % to 100.0 %	NAN	%	V3.15
Magnitude Error (RMS)	0.0 % to 100.0 %	NAN	%	
Phase Error (RMS),	–180.0 deg to +180.0 deg	NAN	deg	
Slot Number (WCDMA),	0 to 15	NAN	–	
I/Q Origin Offset,	–100.0 dB to 0.0 dB	NAN	dBm	
I/Q Imbalance,	–100.0 dB to 0.0 dB	NAN	dB	
UE Power Current	–100.0 dBm to +60.0 dBm	NAN	dB	

Description of command

These commands are always queries. They start a `MODulation:IQANalyzer` measurement (`READ...`) and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

READ:ARRay:MODulation:IQANalyzer:QPSK:IPHase? Normalized I/Q Amplitude
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:IQANalyzer:QPSK:IPHase?
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:IQANalyzer:QPSK:IPHase?
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–2.0 to +2.0,	1st value for normalized I or Q amplitude	NAN	deg	V3.15
... ,	...	...	...	
–2.0 to +2.0	nth value for normalized I or Q amplitude	NAN	deg	

Description of command

These commands are always queries. They return the normalized I and Q amplitudes. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:MLENgth` times 4 (oversampling factor). The available measurement lengths of 2560 or 640 correspond to a time range of 0 chips to 2559 or 0 chips to 639 chips. For WCDMA signals, n is always equal to 4 x 2560 = 10240.

READ:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase? Subarray Results
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?
Read measurement results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–2.0 to +2.0,	1st value for normalized I or Q amplitude	NAN	deg	V3.15
... ,	...	...	...	
–2.0 to +2.0	nth value for normalized I or Q amplitude	NAN	deg	

Description of command

These commands are always queries. They measure and return the normalized I and Q amplitudes in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:IQANalyzer...` commands. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:IQANalyzer...` commands define a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange.

Common Measurements and Command Groups

The commands for the measurement groups in this section are identical or almost identical in both test modes. Minor differences between *Non Signalling* and *Signalling* commands are possible; they will be pointed out throughout the section.

Note: ***Measurements and signalling states***

To perform any kind of measurement and obtain a meaningful result, an appropriate test setup is required (see application examples in chapter 2 of this manual). Consequently, if the measurements reported in this section are performed in Signalling mode, the Connected (CEST) signalling state must be reached before any of the commands retrieving test results `(READ...?, FETCh...?, SAMPle...?,` or `CALCulate...LIMit?)` *can be used. Test configurations, however, can be defined any time.*

Configuration File Management – System MMEMory

The `MMEMory` system provides mass storage capabilities for the CMU. The functionality of this system is included in the *Data* menu; see CMU200/300 operating manual.

The mass storage of the CMU may be internal or external. The internal mass storage device is a section on the internal hard disk that is reserved for mass storage (directory c:\temp). The external mass storage device is either a floppy disk or a PCMCIA memory card, depending on the instrument configuration. The *<msus>* (mass storage unit specifier) parameter in the `MMEMory` commands denotes the root directory of the *INTernal* or *EXTernal* mass storage device.

The <FileName> parameter is a string. The contents of the string may contain characters for specifying subdirectories, e.g. "\TEMP\TRASH\test.txt" for the file named *test.txt* in the *TEMP\TRASH* subdirectory of the root directory or "TEMP\TRASH\test.txt" for the file named *test.txt* in the *TEMP\TRASH* subdirectory of the current directory, to be queried with the base system command `MMEMory:DIRectory [:CURRent]?`. The file name itself may contain the period as a separator for extensions.

MMEMory:SAVE:CURRent *<FileName> [,<msus>]*

Save configurations in current function group and test mode

Parameters	Parameter description	Def. value	Def. unit	FW vers.
"<FileName>",	Name of the config. file to be created	–	–	V3.15
INTernal | EXTernal	Storage device of the config. file	INTernal	–	

Description of command	Sig. State
This command saves the configuration of the current function group and test mode to a configuration file. A "?" in the specified file name will be replaced by current numbers that are automatically incremented, starting with zero. The auto-increment function overwrites an existing file with a "9" in its file name. For instrument settings that may be different in manual and remote control (e.g. the repetition mode for many measurements) the manual setting is saved. The command is available in all function groups. This command is CMU-specific.	all

MMEMory:RECall:CURRent *<FileName> [,<msus>]* Recall configurations in current function group and test mode				
Parameters	Parameter description	Def. value	Def. unit	FW vers.
"<FileName>", **INTernal | EXTernal**	Name of the config. file to be recalled Storage device of the config. file	– INTernal	– –	V3.15
Description of command				Sig. State
This command recalls the configuration of the current function group and test mode from a configuration file. The command is available in all function groups. This command is CMU-specific.				all

Option Query

The *Options* subsystem contains the commands for querying information on the instrument and the available options. It corresponds to the *Options* tab in the *Setup* menu opened via the *SETUP* key on the front panel.

SYSTem:OPTions:INFO:CURRent?	Device Info		
Response	Def. value	Default unit	FW vers.
Example: Rohde&Schwarz,CMU 200-1100.0008.02,840675/018, V3.10C:SP02 2002-10-25"WCDMA19UEFDD_Sig"	–	–	V3.15
Description of command			Sig. State
This command returns the information on the device comprising the manufacturer, model, serial number and firmware version of the current function group. This command is always a query.			all

Partial Reset

The `RESet` subsystem restores the (factory) default values for the current function group and test mode. It is similar to the *Reset* menu opened via the *RESET* key on the front panel.

SYSTem:RESet:CURRent	Partial Reset
Command description	FW vers.
This command sets all parameters of the current function group and test mode to default values. The command is available in all function groups. In contrast to the *Reset* menu the command restores the default values defined for remote control operation. In cases where remote and manual control use distinct settings (e.g. the repetition mode for many measurements), the manual control settings are left unchanged.	V3.15 Sig. State all

I/Q-IF Interface

The subsystem *IQIF* configures the signal paths for I/Q and IF signals provided by option CMU-B17, *I/Q and IF Interfaces*. It corresponds to the *I/Q-IF* tab of the *Connection Control* menu.

Hint: *How to make sense out of parameter names*

In all path configurations except bypass, both the I/Q and IF output are connected (to either the RF Unit, the Digital Unit or one of the I/Q-IF inputs). The paths differ in the connection of the input branches: The qualifier IO denotes a connected input (with connected output), XO denotes a disconnected input (with connected output). Many parameters of the IQIF commands are composed of two IO/XO qualifiers, the first one standing for the IF signal, the second for the I/Q signal.

Example: *The parameter IOXO denotes a connected IF input and a disconnected IF output, while both output branches are connected.*

For more information see Chapter 4 and the application examples in the CMU200/300 operating manual.

CONFigure:IQIF:RXTXcombined <*Scenario*> I/Q-IF

<Scenario>	Description of parameters	Def. value	Def. unit	FW vers.
BYP	RX/TX Bypass, `RXPath = BYP, TXPath = BYP`	BYP	–	V3.15
BYIQ	Bypass w. I/Q-OF OUT, `RXPath = TXPath =BYIQ`			
XOIO	I/Q IN/OUT, `RXPath = TXPath = XOIO`			
IOIO	IF IN_I/Q IN/OUT, `RXPath = TXPath = IOIO`			
IOXO	IF IN/OUT, `RXPath = TXPath = IOXO`			
FPAT	Fading Path, `RXPath = BYP, TXPath = XOIO`			
UDEF	User-defined scenario, can not be set but may be returned by the query `CONF:IQIF:RXTX?`			

Description of command

This command selects the I/Q-IF test scenario, overwriting the current RX and TX path settings (see commands `CONFigure:IQIF:RXPath` and `CONFigure:IQIF:TXPath` below). Six different predefined test scenarios with fixed RX and TX path are provided. Additional scenarios may be defined by selecting any other combination of RX and RX paths.

Note: *`UDEF` is not provided as a setting parameter. If the RX/TX path combination defined via `CONFigure:IQIF:RXPath` and `CONFigure:IQIF:TXPath` doesn't correspond to any of the predefined scenarios, then a user-defined scenario is set implicitly, i.e. the query `CONF:IQIF:RXTX?` returns the value `UDEF`.*

CONFigure:IQIF:RXPath <*Path*> RX Path

<Path>	Description of parameters	Def. value	Def. unit	FW vers.
BYP	Bypass	BYP	–	V3.15
BYIQ	Bypass w. I/Q-IF OUT			
XOIO	I/Q IN/OUT			
IOIO	IF IN_I/Q IN/OUT			
IOXO	IF IN/OUT			

Description of command

This command selects the RX signal path, leaving the TX path (see command `CONFigure:IQIF:TXPath` below) unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then `CONFigure:IQIF:RXTXcombined` is set to the predefined scenario; otherwise it is set to `UDEF`.

CONFigure:IQIF:TXPath *<Path>*				TX Path
<Path>	Description of parameters	Def. value	Def. unit	FW vers.
BYP **BYIQ** **XOIO** **IOIO** **IOXO**	Bypass Bypass w. I/Q-IF OUT I/Q IN/OUT IF IN_I/Q IN/OUT IF IN/OUT	BYP	–	V3.15
Description of command				
This command selects the TX signal path, leaving the RX path (see command `CONFigure:IQIF:RXPath` above) unchanged but adapting the I/Q-IF test scenario to the new RX/TX path combination: If the combination corresponds to a predefined scenario, then `CONFigure:IQIF:RXTXcombined` is set to the predefined scenario; otherwise it is set to `UDEF`.				

[SENSe:]IQIF:LEVel? *<TX Level>*				IF Level
<TX Level>	Description of parameters	Def. value	Def. unit	FW vers.
< 0 dB	IF level	NAN	dBFS	V3.40
Description of command				
This command is always a query and returns the IF output level in the TX path relative to the maximum IF output level (PEP) quoted in the data sheet. The value is equal to the I/Q output level in the TX path relative to the maximum I/Q output voltage quoted in the data sheet.				

DEFault:IQIF <Enable>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to their default values Some or all parameters differ from the default values	ON	–	V3.40
Description of command				
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				

POWer Measurements

The subsystem *POWer* measures the peak and RMS-averaged power of the received RF carrier signal and the inner loop Transmit Power Control (TPC) of the UE. The subsystem corresponds to the measurement menu *Power* and the associated popup menu *Power Configuration.*

The power can be measured under various operating conditions of the UE. In manual control, these operating conditions correspond to the different applications of the *Power* measurement. In remote control, the applications are distinguished by the third-level keywords in the `POWer` commands:

- The third-level keyword `MAXimum` denotes the *Maximum Power* application.
- The third-level keyword `MINimum` denotes the *Minimum Power* application.
- The third-level keyword `OFF` denotes the *OFF Power* application.
- The third-level keyword `ILTPc` denotes the *Inner Loop TPC* application.

The command syntax is similar for the first three applications, so they will be described in common sections. The *Inner Loop TPC* application is described in section *POWer:ILTPc* on p. 6.41 ff.

POW:MAX, POW:MIN, POW:OFF

The subsystems *`POWer:MAXimum, POWer:MINimum, POWer:OFF`* test transmitter output power of the UE under maximum power, minimum power and off power conditions. The subsystems correspond to the measurement menu *Power,* applications *Maximum Power, Minimum Power, Off Power,* and the sections in the popup menu *Power Configuration* that are related to these applications.

Control of Measurement – Subsystems POWer...

The subsystems *POWer:...* controls the power measurement.

INITiate:POWer:MAXimum	Start new measurement	⇒ *RUN*
ABORt:POWer:MAXimum	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:MAXimum	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:MAXimum	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:POWer:MINimum	Start new measurement	⇒ *RUN*
ABORt:POWer:MINimum	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:MINimum	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:MINimum	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:POWer:OFF	Start new measurement	⇒ *RUN*
ABORt:POWer:OFF	Abort running measurement and switch off	⇒ *OFF*
STOP:POWer:OFF	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:POWer:OFF	Next measurement step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the power measurement with a particular application, setting it to the status indicated in the top right column.	V3.00

CONFigure:POWer:MAXimum:EREPorting <*Mode*>
CONFigure:POWer:MINimum:EREPorting <*Mode*>
CONFigure:POWer:OFF:EREPorting <*Mode*>

Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:POWer:MAXimum:STATus?
FETCh:POWer:MINimum:STATus?
FETCh:POWer:OFF:STATus?

Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set	NONE	–	
NONE,				
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off	NONE	–	
NONE				

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems determine the parameters of the power measurement. They correspond to the *Power Configuration* popup menu. For a detailed explanation of the power tolerances defined in the 3GPP standard see Chapter 4.

Subsystem POWer:...CONTrol

The subsystem *POWer:...CONTrol* defines the repetition mode, statistic count, and stop condition of the *Power* measurement. These settings are provided in the *Control* tab in the popup menu *Power Configuration.*

CONFigure:POWer:MAXimum:CONTrol:STATistics <*Statistics*>
CONFigure:POWer:MINimum:CONTrol:STATistics <*Statistics*>
CONFigure:POWer:OFF:CONTrol:STATistics <*Statistics*>

Measurement Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	≥3.0

Description of command

This command defines the number of slots forming a statistics cycle.

Test Cycles

CONFigure:POWer:MAXimum:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>
CONFigure:POWer:MINimum:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>
CONFigure:POWer:OFF:CONTrol:REPetition <*Repetition*>,<*StopCond*>,<*Stepmode*>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000,**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE,**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:POWer:MAXimum:CONTrol:TPControl <*Mode*>
CONFigure:POWer:MINimum:CONTrol:TPControl <*Mode*>

Power Control

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
AUTO | **MANual**	Automatic setting of max. and min. power Manual setting; select appropriate TPC pattern	AUTO	–	V3.40

Description of command

These commands qualify by which mechanism the UE transmitter is set to transmit at its minimum or maximum power.

DEFault:POWer:MAXimum:CONTrol *<Enable>*
DEFault:POWer:MINimum:CONTrol *<Enable>*
DEFault:POWer:OFF:CONTrol *<Enable>*
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

DEFault:POWer:CONTrol *<Enable>*
Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `POWer...:CONTrol` subsystem including all applications to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem POWer:MAXimum:...LIMit

The subsystem *POWer:MAXimum...LIMit* defines the limits for the *Maximum Power* application. The subsystem corresponds to the *Maximum Power* section in the *Limits* tab of the popup menu *Power Configuration.*

CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:UPPer:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS>
Upper Limits, Current & Max/Min

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Upper limit for UE Power (Peak)	2.0	dB	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 5.0 dB	Upper limit for UE Power (RMS)	2.0	dB	V3.00

Description of command

This command defines the upper limits for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* and *Minimum* of several consecutive slots (`CMMax` keyword; compare the commands `CONFigure:POWer: MAXimum:AVERage...` reported below). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:LOWer:VALue
<Lower_Limit_Peak>,<Lower_Limit_RMS> Lower Limits, Current & Max/Min

<Lower_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–5.0 dB to 0.0 dB	Lower limit for UE Power (Peak)	–2.0	dB	
<Lower_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–5.0 dB to 0.0 dB	Lower limit for UE Power (RMS)	–2.0	dB	V3.00

Description of command

This command defines the lower limits for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* and *Minimum* of several consecutive slots (`CMMax` keyword; compare the commands `CONFigure:POWer: MAXimum:AVERage...` reported below). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:RVALue
<Rated_Value_Peak>,<Rated_Value_RMS> Rated Values, Current & Max/Min

<Rated_Value_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Rated value for UE Power (Peak)	+21.0	dBm	
<Rated_Value_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Rated value for UE Power (RMS)	+21.0	dBm	V3.00

Description of command

This command defines the rated values for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* and *Minimum* of several consecutive slots (`CMMax` keyword; compare the commands `CONFigure:POWer: MAXimum:AVERage...` reported below). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS> Upper Limits, Average

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
0.0 dB to 5.0 dB	Upper limit for UE Power (Peak)	2.0	dB	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 5.0 dB	Upper limit for UE Power (RMS)	2.0	dB	V3.00

Description of command

This command defines the upper limits for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MAXimum:CMMax...` reported above). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:LOWer:VALue
<Lower_Limit_Peak>,<Lower_Limit_RMS> Lower Limits, Average

<Lower_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–5.0 dB to 0.0 dB	Lower limit for UE Power (Peak)	–2.0	dB	
<Lower_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–5.0 dB to 0.0 dB	Lower limit for UE Power (RMS)	–2.0	dB	V3.00

Description of command

This command defines the lower limits for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MAXimum:CMMax...` reported above). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:RVALue
<Rated_Value_Peak>,<Rated_Value_RMS> Rated Values, Average

<Rated_Value_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Rated value for UE Power (Peak)	+21.0	dBm	
<Rated_Value_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Rated value for UE Power (RMS)	+21.0	dBm	V3.00

Description of command

This command defines the rated values for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MAXimum:CMMax...` reported above). The keyword `MAXimum` in the command denotes the *Maximum Power* application.

DEFault:POWer:MAXimum:LIMit Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystems POWer:MINimum:...LIMit and POWer:OFF...LIMit

The subsystems *POWer:MINimum...LIMit* and *POWer:OFF...LIMit* define the limits for the *Minimum Power* and *Off Power* applications, respectively. The subsystems correspond to the *Minimum Power* and *Off Power* sections in the *Limits* tab of the popup menu *Power Configuration.*

CONFigure:POWer:MINimum:CMAX:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS>
CONFigure:POWer:OFF:CMAX:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS> Upper Limits, Current & Max

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (Peak)	–50.0 `(MINimum)` –56.0 `(OFF)`	dBm dBm	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (RMS)	–50.0 `(MINimum)` –56.0 `(OFF)`	dBm dBm	V3.00

Description of command

These commands define the upper limits for the peak and RMS-averaged UE output power calculated for the *Current* slot as well as for the *Maximum* of several consecutive slots (`CMAX` keyword; compare the commands `CONFigure:POWer: MINimum:AVERage...` reported below). The keywords `MINimum` and `OFF` in the commands denote the *Minimum Power* and *Off Power* applications, respectively.

CONFigure:POWer:MINimum:AVERage:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS>
CONFigure:POWer:OFF:AVERage:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue
<Upper_Limit_Peak>,<Upper_Limit_RMS> Upper Limits, Average

<Upper_Limit_Peak>	Description of parameters	Def. value	Def. unit	
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (Peak)	–50.0 `(MINimum)` –56.0 `(OFF)`	dBm dBm	
<Upper_Limit_RMS>	Description of parameters	Def. value	Def. unit	FW vers.
–60.0 dBm to +53.0 dBm	Upper limit for UE Power (RMS)	–50.0 `(MINimum)` –56.0 `(OFF)`	dBm dBm	V3.00

Description of command

These commands define the upper limits for the peak and RMS-averaged UE output power calculated for the *Average* of several consecutive slots (`AVERage` keyword; compare the commands `CONFigure:POWer:MINimum:CMAX...` reported above). The keywords `MINimum` and `OFF` in the commands denote the *Minimum Power* and *Off Power* applications, respectively.

DEFault:POWer:MINimum:LIMit Default Settings
DEFault:POWer:OFF:LIMit

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

DEFault:POWer:LIMit Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the `POWer...:LIMit` subsystem including all applications `(MINimum, MINimum, OFF)` to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem POWer...?

The subsystem *POWer...?* measures and returns the results of the signal power measurement. They correspond to the measurement menu *Power* with its various display elements.

	Scalar results:
READ[:SCALar]:POWer:MAXimum?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:MAXimum?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:MAXimum?	Read out measurement results (synchronized)
READ[:SCALar]:POWer:MINimum?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:MINimum?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:MINimum?	Read out measurement results (synchronized)
READ[:SCALar]:POWer:OFF?	Start single shot measurement and return results
FETCh[:SCALar]:POWer:OFF?	Read out measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:OFF?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
UE Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
UE Power (Peak): Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (Peak): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (RMS): Minimum[1]**,**	–100.0 dBm to +60.0 dBm	NAN	dBm	
			–	
Out of Tolerance	0.0 % to 100.0 %	INV	%	

Description of command

These commands are always queries. They start a `POWer` measurement and/or return all scalar measurement results (see also description of measurement control in Chapter 5 of the CMU200/300 manual). The calculation of results is described in section *Averaging and Statistical Evaluation* in Chapter 3.

Note 1: The value *UE Power (RMS), Minimum* is returned in the `MAXimum` application only. It is omitted in the output strings for the `MINimum` and `OFF` commands.

CALCulate[:SCALar]:POWer:MAXimum:MATChing:LIMit?
CALCulate[:SCALar]:POWer:MINimum:MATChing:LIMit?
CALCulate[:SCALar]:POWer:OFF:MATChing:LIMit?

Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
UE Power (Peak): Current,	NMAU | NMAL | INV | OK	INV	–	V3.00
UE Power (Peak): Average,	NMAU | NMAL | INV | OK	INV	–	
UE Power (Peak): Maximum,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Current,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Average,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Maximum,	NMAU | NMAL | INV | OK	INV	–	
UE Power (RMS): Minimum[1]	NMAU | NMAL | INV | OK	INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the tolerances for the peak and RMS-averaged signal power have been exceeded.

The following messages may be output for all values:

NMAU	Tolerance value underflow	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Note 1: The value *UE Power (RMS), Minimum* is returned in the `MAXimum` application only. It is omitted in the output strings for the `MINimum` and `OFF` commands.

POWer:ILTPc

The subsystem `POWer:ILTPc` tests the inner loop Transmit Power Control (TPC) of the UE. The subsystem corresponds to the measurement menu *Power*, application *Inner Loop TPC*, and the sections in the popup menu *Power Configuration* that are related to the *Inner Loop TPC* application.

Control of Measurement – Subsystem POWer:ILTPc

The subsystem *POWer:ILTPc* controls the inner loop TPC measurement. It corresponds to the *Inner Loop TPC* softkey in the measurement menu *Power*.

INITiate:POWer:ILTPc	Start new measurement	⇒	*RUN*
ABORt:POWer:ILTPc	Abort running measurement and switch off	⇒	*OFF*
STOP:POWer:ILTPc	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:POWer:ILTPc	Next measurement step (only *stepping mode*)	⇒	*RUN*
Description of command			FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.			V3.05

CONFigure:POWer:ILTPc:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.05
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			
Description of command				
This command defines the events generated when the measurement is terminated or stopped *(event reporting*, see Chapter 5 of CMU200/300 operating manual).				

FETCh:POWer:ILTPc:STATus?				Measurement Status
Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	–
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE		NONE	–	V3.05
Description of command				
This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).				

Test Configuration

The commands of the following subsystems configure the *Inner Loop TPC* measurement. They correspond to the sections in the popup menu *Power Configuration* that are related to the *Inner Loop TPC* application..

Subsystem POWer:ILTPc:CONTrol

The subsystem *POWer:ILTPc:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Power Configuration*.

CONFigure:POWer:ILTPc:CONTrol:RMODe <*Mode*> Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay,**	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARRay	–	≥3.0

Description of command

This command specifies the type of measured values.

CONFigure:POWer:ILTPc:CONTrol:REPetition
<*Repetition*>,<*StopCond*>,<*Stepmode*> Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.05

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:POWer:ILTPc:CONTrol:TPCControl Profile Length, Step Size, TPC Mode (Non Sig.)
<ProfileLength>, <StepSize>, <TPCMode>

<ProfileLength>	Description of parameters	Def. value	Def. unit	
7 | 10,	No. of power steps to be measured	10	(slots)	
<StepSize>	Description of parameters	Def. value	Def. unit	
1 dB | 2 dB | 3 dB,	Power step size	1	dB	
<TPCMode>	Description of parameters	Def. value	Def. unit	FW vers.
ALG1 | ALG2 | OFF	Power control algorithm	OFF	–	V3.05

Description of command

This command selects the profile length in section A and B of the diagram, the step size between two consecutive power levels and the power control algorithm of the UE.

Note: *This command is available in Non Signalling mode only. In Signalling mode, the TPC Mode and the Step Size are taken from signalling; the profile length is set by means of* `CONFigure:POWer:ILTPc:CONTrol:PLENgth`.

CONFigure:POWer:ILTPc:CONTrol:PLENgth Profile Length (Signalling)
<ProfileLength>

<ProfileLength>	Description of parameters	Def. value	Def. unit	FW vers.
7 | 10	No. of power steps to be measured	10	(slots)	V3.15

Description of command

This command selects the profile length in section A and B of the diagram.

Note: *This command is available in Signalling mode only. In Non Signalling mode, the TPC Mode and the Step Size must be set in addition; they are defined together with the profile length by means of* `CONFigure:POWer:ILTPc:CONTrol:TPCControl`.

CONFigure:POWer:ILTPc:CONTrol:SANalysis *<Quantity>* Step Analysis

<Quantity>	Description of parameters	Def. value	Def. unit	FW vers.
PST | **PSTA |** **PSTE**	Power steps measured Absolute power steps measured Power step errors measured	PST	–	V3.05

Description of command

This command selects the quantity to be measured and returned by the *READ:ARRay:POWer:ILTPc:STEP:CURRent?* etc. commands.

CONFigure:POWer:ILTPc:CONTrol:BSECtion *<Enable>* Section B Analysis
<ProfileLength>, <StepSize>, <TPCMode>

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable measurement in section B	OFF	–	V3.05

Description of command

This command switches the measurement in the second profile length (section B) on or off. Section B can not be enabled while the TPC mode is set to off; see command *CONFigure:POWer:ILTPc:CONTrol:TPCControl.*

CONFigure:POWer:ILTPc:CONTrol:TPCProfile:ALG<nr> *<Enable> <ProfileLength>, <StepSize>, <TPCMode>* Step Control – Section A

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1,	Step Control, Slot 0 –> 1	1	–	
...,				
0 | 1	Step Control, Slot 9 –> 10	1	–	V3.07

Description of command

This command defines the TPC command values for the 10 power steps that can be displayed in section A. The numeric suffix numbers the two TPC modes *Algorithm 1* and *Algorithm 2;* see command CONFigure:POWer:ILTPc:CONTrol:TPCControl.

DEFault:POWer:ILTPc:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF).*

Subsystem POWer:ILTPc:...LIMit

The subsystem *POWer:ILTPc:...LIMit* defines the limits for the *Inner Loop TPC* measurement. The subsystem corresponds to the *Inner Loop TPC* section in the *Limits* tab of the popup menu *Power Configuration.*

CONFigure:POWer:ILTPc:THReshold:CURRent:LIMit[:SCALar]: ASYMmetric[:COMBined]:VALue *<MaxThreshold>,<MinThreshold>* Max. Threshold, Min. Threshold

<MaxThreshold>	Description of parameters	Def. value	Def. unit	
+10.0 dBm to +40.0 dBm	Upper limit of power control range	+19.0	dBm	
<MinThreshold>	Description of parameters	Def. value	Def. unit	FW vers.
–70.0 dBm to –30.0 dBm	Lower limit of power control range	–50.0	dBm	V3.05

Description of command

This command sets the upper and lower limits of the power control range *(Max. Threshold and Min. Threshold* values). The lower (upper) individual power step limits and all average power step limits (see commands below) are ignored in the output power range above *Max. Threshold* (below *Min. Threshold).*

CONFigure:POWer:ILTPc:STEP:CURRent:LIMit[:SCALar]: SYMMetric[:COMBined]:VALue ***<Ind_0dB>, <Ind_1dB>, <Ind_2dB>, <Ind_3dB>, <7Slot_0dB>, <7Slot_3dB>, <10Slot_0dB>, <10Slot_1dB>, <10Slot_2dB>***

Step individual, Step section A/B

<Ind_ndB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 3.0 dB	Step individual limit for step size n dB	0.5 (n = 0, 1) 1.0 (n = 2) 1.5 (n = 3)	dB	
<7Slot_ndB>	Description of parameters	Def. value	Def. unit	
0.0 dB to 9.0 dB	Step section A/B limit for 7-dB pattern length and step size n dB	1.0 (n = 0) 5.0 (n = 3)	dB	
<10Slot_ndB>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 9.0 dB	Step section A/B limit for 10-dB pattern length and step size n dB	1.0 (n = 0) 2.0 (n = 1) 4.0 (n = 2)	dB	V3.05

Description of command

This command sets the symmetric power limits for either 7 or 10 equal TPC_CMD values.

DEFault:POWer:ILTPc:LIMit ***<Enable>***

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.05

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem POWer:ILTPc...?

The subsystem *POWer:ILTPc...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Power,* application *Inner Loop TPC.*

Scalar Results

READ[:SCALar]:POWer:ILTPc:CURRent? Start single shot measurement and return results
FETCh[:SCALar]:POWer:ILTPc:CURRent? Read measurement results (unsynchronized)
SAMPle[:SCALar]:POWer:ILTPc:CURRent? Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power Step Error (TPC_cmd = ±1),	–100.0 dB to +100.0 dB	NAN	dB	V3.05
Avg. Power Step Error (TPC_cmd = 0),	–100.0 dB to +100.0 dB	NAN	dB	
Min./Max. Power Step Error (TPC_cmd = ±1),	–100.0 dB to +100.0 dB	NAN	dB	
Min./Max. Power Step Error (TPC_cmd = 0),	–100.0 dB to +100.0 dB	NAN	dB	
Section A,	–100.0 dB to +100.0 dB	NAN	dB	
Section B,	–100.0 dB to +100.0 dB	NAN	dB	
Max. UE Power,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Min. UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They start a `POWer:ILTPc` measurement (`READ...`) and/or return all scalar measurement results.

CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Avg. Power Step Error (TPC_cmd = ±1),		INV	–	
Avg. Power Step Error (TPC_cmd = 0),	For all measured values:	INV	–	
Min./Max. Power Step Error (TPC_cmd = ±1),	NMAU | NMAL | INV | OK	INV	–	
Min./Max. Power Step Error (TPC_cmd = 0),		INV	–	
Section A,		INV	–	
Section B		INV	–	V3.05

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:POWer:ILTPc:UEPower:CURRent? UE Power bar graph

Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:POWer:ILTPc:UEPower:CURRent?

Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:POWer:ILTPc:UEPower:CURRent?

Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for UE Power	–100.0 dBm to +60.0 dBm,	NAN	dBm	V3.05
...	... ,	...	...	
nth value for UE Power	–100.0 dBm to +60.0 dBm	NAN	dBm	

Description of command

These commands are always queries. They return the UE power in a series of consecutive slots. The number n of measured values is 16 or 22, depending on the profile length (command `CONFigure:POWer:ILTPc:CONTrol:TPCControl`). If section B analysis is switched off (see command `CONFigure:POWer:ILTPc:CONTrol:BSECtion`) no entries are made in the second half of the output arrays (the default values *NAN* are maintained).

READ:ARRay:POWer:ILTPc:STEP:CURRent? Power Step bar graph

Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:POWer:ILTPc:STEP:CURRent?

Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:POWer:ILTPc:STEP:CURRent?

Read measurement results (synchronized) ⇒ *RUN*

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for abs. power step	–100.0 dB to +100.0 dB,	NAN	dB	V3.05
...	... ,	...	...	
nth value for abs. power step	–100.0 dB to +100.0 dB	NAN	dB	

Description of command

These commands are always queries. They return the absolute power step in a series of consecutive slots. The measured quantity can be changed to the power step or power step error using the `CONFigure:POWer:ILTPc:CONTrol:SANalysis` command. The number n of measured values is 14 or 20, depending on the profile length (command `CONFigure:POWer:ILTPc:CONTrol:TPCControl`). If section B analysis is switched off (see command `CONFigure:POWer:ILTPc:CONTrol:BSECtion`) no entries are made in the second half of the output arrays (the default values *NAN* are maintained).

CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for power step error	For all measured values:	INV	–	V3.05
...				
nth value for power step error	NMAU | NMAL | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit?				Limit Matching
Returned values	Value range	Def. value	Def. unit	FW vers.
1st value for power step error ... **nth value for power step error**	For all measured values: INV | NORM | MAXT | MINT	INV INV	– –	V3.07

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded.

The following messages may be returned for all measured values:

MAXT	Maximum threshold exceeded
MINT	Minimum threshold exceeded
INV	Measurement invalid
NORM	Result within the tolerance

MODulation Measurements

The subsystem *MODulation* measures the modulation accuracy of the RF signal from the UE. The subsystem corresponds to the measurement menu *Modulation* with its various applications and the associated popup menu *Modulation Configuration.*

The modulation parameters can be measured for a single QPSK-modulated signal or a multiple WCDMA signal with channel coding. In manual control, these signal configurations correspond to the different *QPSK* and *WCDMA* applications of the *Modulation* measurement. In remote control, the signal configurations are distinguished by the fourth-level keywords in the `MODulation` commands:

- The third-level keyword `QPSK` denotes the *QPSK* applications.
- The third-level keyword `WCDMa` denotes the *WCDMA* applications.

The command syntax is similar for both applications, so they will be described in common sections. In contrast, the four applications `OVERview`, `EVMagnitude`, `MERRor`, and `PERRor` will be described in separate sections.

General Commands

The commands in this section provide general settings that affect several MODulation measurement applications.

CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode <*Mode*>				Channelization Code Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
AUTomatic | **MANual**	Automatic search of channelization codes Channelization codes are set manually	AUT	–	V3.00

Description of command

This command affects all *WCDMA* applications. It determines whether the CMU searches for the channelization codes assuming the *AUTO* settings of the *UE Code* tab or whether the channelization code is set manually (`MANual` settings of the *UE Code* tab).

In `CDPower` measurements (see section *CDPower Measurements* on p. 6.99), the applications `AUTomatic` and `RAUTomatic` correspond to `AUTomatic` channelization code mode, the applications `MANual` and `RMANual` correspond to `MANual` channelization code mode.

MODulation:OVERview

The subsystem *MODulation:OVERview* measures scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* application *Overview...,* and the sections in the popup menu *Modulation Configuration* that are related to the *Overview...* applications.

Control of Measurement – Subsystem MODulation:OVERview

The subsystem *MODulation:OVERview* controls the modulation measurement. It corresponds to the softkeys *Overview QPSK* and *Overview WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:OVERview:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:OVERview:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:OVERview:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:OVERview:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:OVERview:WCDMa:DPCH	Start new measurement	
ABORt:MODulation:OVERview:WCDMa:DPCH	Abort running measurement and switch off	
STOP:MODulation:OVERview:WCDMa:DPCH	Stop measurement after current stat. cycle	
CONTinue:MODulation:OVERview:WCDMa:DPCH	Next meas. step (only *stepping mode*)	

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:OVERview:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:OVERview:WCDMa:DPCH:EREPorting <*Mode*>

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:OVERview:QPSK:STATus? Measurement Status
FETCh:MODulation:OVERview:WCDMa:DPCH:STATus?

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Overview QPSK* and *Overview WCDMA* applications.

Subsystem MODulation:OVERview:...:CONTrol

The subsystem *MODulation:OVERview:QPSK:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:OVERview:QPSK:CONTrol:STATistics *<Statistics>*
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:STATistics *<Statistics>*
Meas. Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	≥3.0

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:OVERview:QPSK:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>
Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: *In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.*

CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth *<Length>*
Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement but does not change the format or length of the output.

DEFault:MODulation:OVERview:QPSK:CONTrol *<Enable>*
DEFault:MODulation:OVERview:WCDMa:DPCH:CONTrol *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP:...:LIMit

The subsystem *MODulation:OEMP:....:LIMit* defines tolerance values for the modulation measurement **in all applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Limits: Current & Max/Min

CONFigure:MODulation:OEMP:QPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>

CONFigure:MODulation:OEMP:WCDMa:DPCH:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>, <Peak Code Domain Error>, <Transmit Time Error>

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +20.0 %,	Error Vector Magn. (Peak)	+17.5	%	V3.00
0.0 % to +20.0 %,	Error Vector Magn. (RMS)	+17.5	%	
–20.0 % to +20.0 %,	Magnitude Error (Peak)	±17.5	%	
0.0 % to +20.0 %,	Magnitude Error (RMS)	+17.5	%	
–20.0 deg to +20.0 deg,	Phase Error (Peak)	±10.0	deg	
0.0 deg to +20.0 deg,	Phase Error (RMS)	+10.0	deg	
–80.00 dB to –20.00 dB,	I/Q Origin Offset	–25.0	dB	
–99.00 dB to 0.00 dB,	I/Q Imbalance	–15.0	dB	
–4000 Hz to +4000 Hz	Carrier Frequency Error	±200	Hz	
+0.9000 to +0.9999	Waveform Quality	+0.9440	–	
	For WCDMa:DPCH only:			
–40.0 dB to 0.0 dB	Peak Code Domain Error	–15.0	dB	
–25.0 µs to +25.0 µs	Transmit Time Error (not available in current FW version)	±0.06	µs	

Description of command

This command defines upper limits for the *Current* and *Max./Min.* traces evaluated over the whole evaluation period and for the scalar modulation parameters derived from them. For parameters with symmetric ranges of limits (e.g. the Phase Error (Peak)), the entry of positive or negative values (say +x or –x) is equivalent: The limit will be interpreted in such a way that the parameter must be confined in the range [–x,+x].

Limits: Average

CONFigure:MODulation:OEMP:QPSK:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>

CONFigure:MODulation:
OEMP:WCDMa:DPCH:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue
<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>, <I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>, <Peak Code Domain Error>, <Transmit Time Error>

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +20.0 %,	Error Vector Magn. (Peak)	+17.5	%	V3.00
0.0 % to +20.0 %,	Error Vector Magn. (RMS)	+17.5	%	
–20.0 % to +20.0 %,	Magnitude Error (Peak)	±17.5	%	
0.0 % to +20.0 %,	Magnitude Error (RMS)	+17.5	%	
–20.0 deg to +20.0 deg,	Phase Error (Peak)	±10.0	deg	
0.0 deg to +20.0 deg,	Phase Error (RMS)	+10.0	deg	
–80.00 dB to –20.00 dB,	I/Q Origin Offset	–25.0	dB	
–99.00 dB to 0.00 dB,	I/Q Imbalance	–15.0	dB	
–4000 Hz to +4000 Hz	Carrier Frequency Error	±200	Hz	
+0.9000 to +0.9999	Waveform Quality	+0.9440	–	
	For WCDMa:DPCH only:			
–40.0 dB to 0.0 dB	Peak Code Domain Error	–15.0	dB	
–25.0 µs to +25.0 µs	Transmit Time Error (not available in current FW version)	±0.06	µs	

Description of command

This command defines upper limits for the *Current* and *Max./Min.* traces evaluated over the whole evaluation period and for the scalar modulation parameters derived from them. For parameters with symmetric ranges of limits (e.g. the Phase Error (Peak)), the entry of positive or negative values (say +x or –x) is equivalent: The limit will be interpreted in such a way that the parameter must be confined in the range [–x,+x].

DEFault:MODulation:OEMP:QPSK:LIMit *<Enable>*
DEFault:MODulation:OEMP:WCDMa:DPCH:LIMit *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem MODulation:OVERview:QPSK

The subsystem *MODulation:OVERview:QPSK* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* application *Overview QPSK* and *Overview WCDMA.*

READ[:SCALar]:MODulation:OVERview:QPSK? Scalar Results:
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:OVERview:QPSK?
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:OVERview:QPSK?
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),	0.0 % to 100.0 %	NAN	%	V3.00
EVM (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
Magn. Error (Peak) (x3),	0.0 % to 100.0 %	NAN	%	
Magn. Error (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
Phase Error (Peak) (x3),	–180.0 deg to +180.0 deg	NAN	deg	
Phase Error (RMS) (x3),	–180.0 deg to +180.0 deg	NAN	deg	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
I/Q Imbalance (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Waveform Quality (x3),	0.0 to +1.0	NAN	–	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
Transmit Time Error (x3, WCDMA) (not available in current FW version),	NAN, NAN, NAN,	NAN	µs	
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:OVERview` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE? Scalar Results:
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Branch of max. PCDE (Current)	I | Q	NAN	–	V3.15
PCDE Code (Current),	0 to SF (depending on signal config.)	NAN	–	
Branch of max. PCDE (Max/Min)	I | Q	NAN	–	
PCDE Code (Max./Min.)	0 to SF	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:OVERview` measurement `(READ...)` and/or return the code number with the largest code domain error. The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*).

CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit?
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:MATChing:LIMit?

Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),		INV	–	V3.00
EVM (RMS) (x3),		INV	–	
Magn. Error (Peak) (x3),	For all measured values:	INV	–	
Magn. Error (RMS) (x3),		INV	–	
Phase Error (Peak) (x3),		INV	–	
Phase Error (RMS) (x3),		INV	–	
I/Q Origin Offset (x3),	NMAU | NMAL | INV | OK	INV	–	
I/Q Imbalance (x3),		INV	–	
Frequency Error (x3),		INV	–	
Waveform Quality (x3)		INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3),		INV	–	
Transmit Time Error (x3) (not available in current FW version)	INV, INV, INV	INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands above) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value.

The following messages may be returned for all measured values:

NMAU *not matching, underflow*	Underflow of tolerance value
NMAL *not matching, overflow*	Tolerance value exceeded
INV *invalid*	Measurement invalid
OK	Result within the tolerance

MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* measures the error vector magnitude as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* applications *EVM QPSK* and *EVM WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *EVM...* applications.

Control of Measurement – Subsystem MODulation:EVMagnitude

The subsystem *MODulation:EVMagnitude* controls the modulation measurement. It corresponds to the softkeys *EVM QPSK* and *EVM WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:EVMagnitude:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:EVMagnitude:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:EVMagnitude:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:EVMagnitude:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:EVMagnitude:WCDMa:DPCH	Start new measurement	
ABORt:MODulation:EVMagnitude:WCDMa:DPCH	Abort running measurement and switch off	
STOP:MODulation:EVMagnitude:WCDMa:DPCH	Stop measurement after current stat. cycle	
CONTinue:MODulation:EVMagnitude:WCDMa:DPCH	Next meas. step (only *stepping mode*)	

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:EVMagnitude:QPSK:EREPorting <*Mode*> Event Reporting
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:EREPorting <*Mode*>

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00

Description of command
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:EVMagnitude:QPSK:STATus?
FETCh:MODulation:EVMagnitude:WCDMa:DPCH:STATus?
Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *EVM* applications.

Subsystem MODulation:EVMagnitude...:CONTrol

The subsystem *MODulation:EVMagnitude...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:RMODe <*Mode*>
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:RMODe <*Mode*>
Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	≥3.0
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:STATistics <*Statistics*>
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:STATistics <*Statistics*>
Meas. Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	≥3.0
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:MLENgth *<Length>*

Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured (QPSK signals only). A small measurement length accelerates the measurement and causes the output arrays to be truncated.

DEFault:MODulation:EVMagnitude:QPSK:CONTrol *<Enable>*
DEFault:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP:QPSK:LIMit

The subsystem *MODulation:OEMP:...:LIMit* (see section *Tolerance values – Subsystem MODulation:OEMP:...:LIMit* on p. 6.52 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:EVMagnitude:QPSK Definition of Subarrays
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
0 chips to 2559 chips,	Start time in current range	0	chips	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 2560	Number of samples in current range	640	–	V3.00

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:EVMagnitude...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter of a slot (see commands `CONFigure:MODulation:EVMagnitude: QPSK:CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 chips, the maximum number of samples is 640.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:EVMagnitude:QPSK

The subsystem *MODulation:EVMagnitude:...?* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *EVM QPSK* and *EVM WCDMA*.

READ[:SCALar]:MODulation:EVMagnitude:QPSK? Scalar Results:
READ[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:EVMagnitude:QPSK?
FETCh[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:EVMagnitude:QPSK?
SAMPle[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),	0.0 % to 100.0 %	NAN	%	V3.00
EVM (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:EVMagnitude` measurement (`READ...`) and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

CALCulate[:SCALar]:MODulation:EVMagnitude:QPSK:MATChing:LIMit? **Limit Matching**
CALCulate[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (Peak) (x3),		INV	–	V3.00
EVM (RMS) (x3),	For all measured values:	INV	–	
I/Q Origin Offset (x3),		INV	–	
Frequency Error (x3)	NMAU | NMAL | INV | OK	INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3)		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands aboves) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *Max./Min.* value. The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:MODulation:EVMagnitude:QPSK:CURRent? EVM in Evaluation period
READ:ARRay:MODulation:EVMagnitude:QPSK:AVERage?
READ:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:MODulation:EVMagnitude:QPSK:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:CURRent? SAMPle:ARRay:MODulation:EVMagnitude:QPSK:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:MMAX?
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent? SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to +100.0 %,	1st value for error vector magnitude	NAN	%	V3.00
... ,	...	...	...	
0.0 % to +100.0 %	nth value for error vector magnitude	NAN	%	

Description of command

These commands are always queries. They return the error vector magnitude vs. time at fixed, equidistant test points with a 1-chip raster. The number n of measured values for QPSK signals is equal to the measurement length set via `CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:MLENgth`. The available measurement lengths of 2560 or 640 correspond to a time range of 0 chips to 2559 or 0 chips to 639 chips. For WCDMA signals, n is always equal to 2560.

The calculation of *Current, Average*, and *MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*

FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read meas. results (unsynchronized) ⇒ *RUN*

SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent? SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent? SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
0.0 % to+ 100.0 %,	1st value for error vector magnitude	NAN	%	V3.00
... ,	...	...	...	
0.0 % to+ 100.0 %	nth value for error vector magnitude	NAN	%	

Description of command

These commands are always queries. They measure and return the error vector magnitude versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:EVMagnitude...` commands. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:EVMagnitude...` commands define a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

MODulation:MERRor

The subsystem *MODulation:MERRor* measures the magnitude error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* applications *Magn. Error QPSK* and *Magn. Error WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *Magn. Error* ... applications.

Control of Measurement – Subsystem MODulation:MERRor

The subsystem *MODulation:MERRor* controls the modulation measurement. It corresponds to the softkeys *Magn. Error QPSK* and *Magn. Error WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:MERRor:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:MERRor:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:MERRor:WCDMa:DPCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:MERRor:WCDMa:DPCH	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:MERRor:WCDMa:DPCH	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:MERRor:WCDMa:DPCH	Next meas. step (only *stepping mode*)	⇒ *RUN*
Description of command		FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.		V3.00

CONFigure:MODulation:MERRor:QPSK:EREPorting <*Mode*> **CONFigure:MODulation:MERRor:WCDMa:DPCH:EREPorting <*Mode*>**				Event Reporting
<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00
Description of command				
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).				

FETCh:MODulation:MERRor:QPSK:STATus?
FETCh:MODulation:MERRor:WCDMa:DPCH:STATus?

Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Magn. Error* applications.

Subsystem MODulation:MERRor...:CONTrol

The subsystem *MODulation:MERRor...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration*.

CONFigure:MODulation:MERRor:QPSK:CONTrol:RMODe <*Mode*>
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:RMODe <*Mode*>

Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	≥3.0
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:MERRor:QPSK:CONTrol:STATistics <*Statistics*>
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:STATistics <*Statistics*>

Meas. Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	≥3.0
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:MERRor:QPSK:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:MERRor:QPSK:CONTrol:MLENgth *<Length>*

Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured (QPSK signals only). A small measurement length accelerates the measurement and causes the output arrays to be truncated.

DEFault:MODulation:MERRor:QPSK:CONTrol *<Enable>*
DEFault:MODulation:MERRor:WCDMa:DPCH:CONTrol *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP...:LIMit

The subsystem *MODulation:OEMP:...:LIMit* (see section *Tolerance values – Subsystem MODulation:OEMP:...:LIMit* on p. 6.52 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:MERRor:QPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:MERRor:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	**Description of parameters**	**Def. value**	**Def. unit**	
0 chips to **2559 chips,**	Start time in current range	0	chips	
<Samples>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
1 to 2560	Number of samples in current range	640	–	V3.00

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:MERRor...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter of a slot (see command `CONFigure:MODulation:MERRor :QPSK:CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 chips, the maximum number of samples is 640.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:MERRor:...?

The subsystem *MODulation:MERRor:...?* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *Magn. Error QPSK* and *Magn. Error WCDMA.*

READ[:SCALar]:MODulation:MERRor:QPSK?
READ[:SCALar]:MODulation:MERRor:WCDMa:DPCH?

Scalar Results:

Start single shot measurement and return results

FETCh[:SCALar]:MODulation:MERRor:QPSK?
FETCh[:SCALar]:MODulation:MERRor:WCDMa:DPCH?

Read out meas. results (unsynchronized)

SAMPle[:SCALar]:MODulation:MERRor:QPSK?
SAMPle[:SCALar]:MODulation:MERRor:WCDMa:DPCH?

Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Magn. Error (Peak) (x3),	0.0 % to 100.0 %	NAN	%	V3.00
Magn. Error (RMS) (x3),	0.0 % to 100.0 %	NAN	%	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:MERRor` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

CALCulate[:SCALar]:MODulation:MERRor:QPSK:MATChing:LIMit?
CALCulate[:SCALar]:MODulation:MERRor:WCDMa:DPCH:MATChing:LIMit?

Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
Magn. Error (Peak) (x3),		INV	–	V3.00
Magn. Error (RMS) (x3),	For all measured values:	INV	–	
I/Q Origin Offset (x3),		INV	–	
Frequency Error (x3)	NMAU | NMAL | INV | OK	INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3)		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands aboves) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:MODulation:MERRor:QPSK:CURRent? Magn. Error in Evaluation period
READ:ARRay:MODulation:MERRor:QPSK:AVERage?
READ:ARRay:MODulation:MERRor:QPSK:MMAX?
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:MODulation:MERRor:QPSK:CURRent?
FETCh:ARRay:MODulation:MERRor:QPSK:AVERage?
FETCh:ARRay:MODulation:MERRor:QPSK:MMAX?
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:MODulation:MERRor:QPSK:CURRent?
SAMPle:ARRay:MODulation:MERRor:QPSK:AVERage?
SAMPle:ARRay:MODulation:MERRor:QPSK:MMAX?
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 % to +100.0 %,	1st value for magnitude error	NAN	%	V3.00
... ,	...	...	...	
–100.0 % to +100.0 %	nth value for magnitude error	NAN	%	

Description of command

These commands are always queries. They return the magnitude error vs. time at fixed, equidistant test points with a 1-chip raster. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:MERRor: QPSK:CONTrol:MLENgth`. The available measurement lengths of 2560 or 640 correspond to a time range of 0 chips to 2559 or 0 chips to 639 chips. For WCDMA signals, n is always equal to 2560.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

Subarray Results

READ:SUBarrays:MODulation:MERRor:QPSK:CURRent?
READ:SUBarrays:MODulation:MERRor:QPSK:AVERage?
READ:SUBarrays:MODulation:MERRor:QPSK:MMAX?
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?

Start single shot measurement and return results ⇒ *RUN*

FETCh:SUBarrays:MODulation:MERRor:QPSK:CURRent?
FETCh:SUBarrays:MODulation:MERRor:QPSK:AVERage?
FETCh:SUBarrays:MODulation:MERRor:QPSK:MMAX?
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?

Read meas. results (unsynchronized) ⇒ *RUN*

SAMPle:SUBarrays:MODulation:MERRor:QPSK:CURRent? SAMPle:SUBarrays:MODulation:MERRor:QPSK:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:QPSK:MMAX?
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent? SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?

Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 % to +100.0 %,	1st value for magnitude error	NAN	%	V3.00
... ,	...	...	...	
–100.0 % to +100.0 %	nth value for magnitude error	NAN	%	

Description of command

These commands are always queries. They measure and return the magnitude error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:MERRor...` commands. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:MERRor...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

MODulation:PERRor

The subsystem *MODulation:PERRor* measures the phase error as well as general scalar modulation parameters. The subsystem corresponds to the measurement menu *Modulation,* applications *Phase Error QPSK* and *Phase Error WCDMA,* and the sections in the popup menu *Modulation Configuration* that are related to the *Phase Error...* applications.

Control of Measurement – Subsystem MODulation:PERRor

The subsystem *MODulation:PERRor* controls the modulation measurement. It corresponds to the softkeys *Phase Error QPSK* and *Phase Error WCDMA* in the measurement menu *Modulation*.

INITiate:MODulation:PERRor:QPSK	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:QPSK	Abort running measurement and switch off	⇒ *OFF*
STOP:MODulation:PERRor:QPSK	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:QPSK	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:MODulation:PERRor:WCDMa:DPCH	Start new measurement	⇒ *RUN*
ABORt:MODulation:PERRor:WCDMa:DPCH	Abort running meas. and switch off	⇒ *OFF*
STOP:MODulation:PERRor:WCDMa:DPCH	Stop meas. after current stat. cycle	⇒ *STOP*
CONTinue:MODulation:PERRor:WCDMa:DPCH	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the modulation measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:MODulation:PERRor:QPSK:EREPorting <*Mode*>
CONFigure:MODulation:PERRor:WCDMa:DPCH:EREPorting <*Mode*>
Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:MODulation:PERRor:QPSK:STATus?
FETCh:MODulation:PERRor:WCDMa:DPCH:STATus? Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Modulation* measurement. They correspond to the sections in the *Modulation Configuration* menu that are related to the *Phase Error* applications.

Subsystem MODulation:PERRor:QPSK:CONTrol

The subsystem *MODulation:PERRor...:CONTrol* configures the scope of the modulation measurement. It corresponds to the *Control* tab in the popup menu *Modulation Configuration.*

CONFigure:MODulation:PERRor:QPSK:CONTrol:RMODe *<Mode>* Result Mode
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:RMODe *<Mode>*

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	≥3.0
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:MODulation:PERRor:QPSK:CONTrol:STATistics *<Statistics>* Measurement Statistics
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:STATistics *<Statistics>*

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	≥3.0
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:MODulation:PERRor:QPSK:CONTrol:REPetition Test Cycles
<Repetition>,<StopCond>,<Stepmode>
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:REPetition
<Repetition>,<StopCond>,<Stepmode>

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:MODulation:PERRor:QPSK:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
640 | 2560	Number of chip periods measured	640 (QPSK) 2560 (WCDMA)	(chips) (chips)	V3.00

Description of command

This command selects the time interval to be measured (QPSK signals only). A small measurement length accelerates the measurement and causes the output arrays to be truncated.

DEFault:MODulation:PERRor:QPSK:CONTrol *<Enable>* Default Settings
DEFault:MODulation:PERRor:WCDMa:DPCH:CONTrol *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem MODulation:OEMP...:LIMit

The subsystem *MODulation:OEMP...:LIMit* (see section *Tolerance values – Subsystem MODulation:OEMP:...:LIMit* on p. 6.52 ff) defines tolerance values for the modulation measurement **in all four applications**. The subsystem corresponds to the *Limits* tab in the popup menu *Modulation Configuration.*

Subsystem SUBarrays:MODulation

The subsystem *SUBarrays:MODulation* defines the measurement range and the type of output values.

CONFigure:SUBarrays:MODulation:PERRor:QPSK
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}
CONFigure:SUBarrays:MODulation:PERRor:WCDMa:DPCH
<Mode>,<Start>,<Samples>{,<Start>,<Samples>}

Definition of Subarrays

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start>	Description of parameters	Def. value	Def. unit	
0 chips to 2559 chips,	Start time in current range	0	chips	
<Samples>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 2560	Number of samples in current range	640	–	V3.00

Description of command

This command configures the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:MODulation:PERRor...` commands. It restricts the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start time and the number of test points which are located on a fixed, equidistant grid with a step width of 1 chip period.

The subranges may overlap but must be within the total range of the *Modulation* measurement. Test points outside this range are not measured (result *NAN)* and do not enter into the ARIThmetical, MINimum and MAXimum values. If the measurement length is reduced to the first quarter of a slot (see command `CONFigure:MODulation:PERRor:QPSK: CONTrol:MLENgth`), then the start value must be in the range between 0 chips and 639 chips, the maximum number of samples is 640.

By default, only one range corresponding to the total measurement range is used and all measurement values are returned.

Measured Values – Subsystem MODulation:PERRor:QPSK

The subsystem *MODulation:PERRor:...?* measures and returns the modulation parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *MODulation,* applications *Phase Error QPSK* and *Phase Error WCDMA.*

READ[:SCALar]:MODulation:PERRor:QPSK? Scalar Results:
READ[:SCALar]:MODulation:PERRor:WCDMa:DPCH?
Start single shot measurement and return results
FETCh[:SCALar]:MODulation:PERRor:QPSK?
FETCh[:SCALar]:MODulation:PERRor:WCDMa:DPCH?
Read out meas. results (unsynchronized)
SAMPle[:SCALar]:MODulation:PERRor:QPSK?
SAMPle[:SCALar]:MODulation:PERRor:WCDMa:DPCH?
Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Phase Error (Peak) (x3),	–180.0 deg to +180.0 deg	NAN	deg	V3.00
Phase Error (RMS) (x3),	–180.0 deg to +180.0 deg	NAN	deg	
I/Q Origin Offset (x3),	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error (x3),	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
Peak Code Dom. Error (x3, WCDMA),	–100.0 dB to 0.0 dB	NAN		
UE Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0.0 % to 100.0 %	NAN	%	
Slot Number (WCDMA)	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `MODulation:PERRor` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4). The calculation of results in an *average* or *peak* measurement is described in Chapter 3 (see section *Averaging and Statistical Evaluation*). The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average*, and the *Max./Min.* value. Values marked WCDMA are not available in the QPSK application; the QPSK output string is shortened.

CALCulate[:SCALar]:MODulation:PERRor:QPSK:MATChing:LIMit? Limit Matching
CALCulate[:SCALar]:MODulation:PERRor:WCDMa:DPCH:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
Phase Error (Peak) (x3),		INV	–	V3.00
Phase Error (RMS) (x3),	For all measured values:	INV	–	
I/Q Origin Offset (x3),		INV	–	
Frequency Error (x3)	NMAU | NMAL | INV | OK	INV	–	
for WCDMA only:				
,Peak Code Dom. Error (x3)		INV	–	

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the scalar measured values (see commands aboves) have been exceeded. The symbol (x3) behind a value indicates that the list contains three results corresponding to the *Current*, the *Average,* and the *Max./Min.* value. The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:MODulation:PERRor:QPSK:CURRent? Phase Error in Evaluation period
READ:ARRay:MODulation:PERRor:QPSK:AVERage?
READ:ARRay:MODulation:PERRor:QPSK:MMAX?
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:MODulation:PERRor:QPSK:CURRent?
FETCh:ARRay:MODulation:PERRor:QPSK:AVERage?
FETCh:ARRay:MODulation:PERRor:QPSK:MMAX?
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:MODulation:PERRor:QPSK:CURRent?
SAMPle:ARRay:MODulation:PERRor:QPSK:AVERage?
SAMPle:ARRay:MODulation:PERRor:QPSK:MMAX?
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–180.0 deg to +180.0 deg,	1st value for phase error	NAN	deg	V3.00
... ,	...	...	...	
–180.0 deg to +180.0 deg	nth value for phase error	NAN	deg	

Description of command

These commands are always queries. They return the phase error vs. time at fixed, equidistant test points with a 1-chip raster. The number n of measured values is equal to the measurement length set via `CONFigure:MODulation:PERRor:QPSK :CONTrol:MLENgth`. The available measurement lengths of 2560 or 640 correspond to a time range of 0 chips to 2559 or 0 chips to 639 chips. For WCDMA signals, n is always equal to 2560.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

READ:SUBarrays:MODulation:PERRor:QPSK:CURRent? Subarray Results
READ:SUBarrays:MODulation:PERRor:QPSK:AVERage?
READ:SUBarrays:MODulation:PERRor:QPSK:MMAX?
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:MODulation:PERRor:QPSK:CURRent?
FETCh:SUBarrays:MODulation:PERRor:QPSK:AVERage?
FETCh:SUBarrays:MODulation:PERRor:QPSK:MMAX?
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:MODulation:PERRor:QPSK:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:QPSK:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:QPSK:MMAX?
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–180.0 deg to +180.0 deg,	1st value for phase error	NAN	deg	V3.00
... ,	...	...	...	
–180.0 deg to +180.0 deg	nth value for phase error	NAN	deg	

Description of command

These commands are always queries. They measure and return the phase error versus time in the subranges defined by means of the `CONFigure:SUBarrays:MODulation:PERRor...` commands. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:MODulation:PERRor...` commands define a maximum of 32 subranges. If one of the statistical modes (`ARIThmetical`, `MINimum`, `MAXimum`) is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

SPECtrum Measurements

The subsystem *SPECtrum* measures the output RF spectrum emissions (off-carrier power) and returns them as a function of the frequency. The subsystem corresponds to the measurement menu *Spectrum* with its various applications and the associated popup menu *Spectrum Configuration.*

The off-carrier power can be assessed with different measurement methods. In manual control, these operating conditions correspond to the different applications of the *Spectrum* measurement. In remote control, the applications are distinguished by the third-level keywords in the `SPECtrum` commands:

- The third-level keyword `MFILter` denotes the *ACLR Filter* application.
- The third-level keyword `MFFT` denotes the *ACLR FFT/OBW* application.
- The third-level keyword `EMASk` denotes the *Emission Mask* application.

The three applications will be described in separate sections.

SPECtrum:MFILter

The subsystem *`SPECtrum:MFILter`* measures the Adjacent Channel Leakage power Ratio (ACLR) using an RRC filter and returns the result at the carrier frequency plus four different off-carrier frequencies. The subsystem corresponds to the measurement menu *Spectrum,* application *ACLR Filter,* and the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR Filter* application.

Control of Measurement – Subsystem SPECtrum:MFILter

The subsystem *SPECtrum:MFILter* controls the *Spectrum* measurement. It corresponds to the *ACLR Filter* softkey in the measurement menu *Spectrum.*

INITiate:SPECtrum:MFILter **ABORt:SPECtrum:MFILter** **STOP:SPECtrum:MFILter** **CONTinue:SPECtrum:MFILter**	Start new measurement Abort running measurement and switch off Stop measurement after current stat. cycle Next measurement step (only *stepping mode*)	⇒ ⇒ ⇒ ⇒	*RUN* *OFF* *STOP* *RUN*
Description of command			FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.			V3.00

CONFigure:SPECtrum:MFILter:EREPorting <*Mode*>				Event Reporting
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00
Description of command				
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).				

FETCh:SPECtrum:MFILter:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V3.00
1 to 10000 | **NONE,**	Counter for current statistics cycle No counting mode set	NONE	–	
1 to 1000 | **NONE**	Counter for current evaluation period within a cycle Statistic count set to off	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Spectrum* measurement. They correspond to the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR Filter* application..

Subsystem SPECTrum:MFILter:CONTrol

The subsystem *SPECtrum:MFILter:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MFILter:CONTrol:STATistics *<Statistics>* Measurement Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	V3.00

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:SPECtrum:MFILter:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP |	Interrupt measurement after each statistics cycle	NONE	–	V3.00
NONE	Continue measurement according to its rep. mode			

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:SPECtrum:MFILter:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
320 | 640 | 1280 | 2560	Number of chip periods measured	640	(chips)	V3.00

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement but does not change the format or length of the output.

CONFigure:SPECtrum:MFILter:CONTrol:UEPMeasure *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	Enable UE power measurement	OFF	–	V3.05
OFF	Disable UE power measurement			

Description of command

This command switches the UE power measurement in the `MFILter` application on or off. Without the UE power, the `MFILter` measurement is faster.

DEFault:SPECtrum:MFILter:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

CONFigure:SPECtrum:CONTrol:HDYNamic *<Enable>* High Dynamic Range

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	High dynamic range setting on or off	OFF	–	V3.00

Description of command

This command switches the input path setting for high dynamic range on or off. The setting is valid for all applications of the `SPECtrum` measurement group. It does not supersede the `[SENSe:]LEVel:ATTenuation` setting that remains valid for all other measurement groups.

Subsystem SPECTrum:MFILter:...LIMit

The subsystem *SPECtrum:MFILter:...LIMit* defines the limits for the *ACLR Filter* measurement. The subsystem corresponds to the *ACLR Filter* section in the *Limits* tab of the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MFILter:RPEak:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue *<ACLR_Limit>*
CONFigure:SPECtrum:MFILter:RRMS:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue *<ACLR_Limit>*
CONFigure:SPECtrum:MFILter:RRMS:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue *<ACLR_Limit>*

Relative Limits

<nr>	Description of parameters	Def. value	Def. unit	
1 | 2 | 3 | 4	Channel number;	–	–	
<ACLR_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dB to 0.0 dB **–80.0 dB to 0.0 dB**	Upper limit for the ACLR if <nr> = ±2 Upper limit for the ACLR if <nr> = ±1	–43 –33	dBc dBc	V3.00

Description of command

These commands define upper limits for the ACLR measured with the direct filter method. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The channel frequency is the channel number times 5 MHz from the carrier frequency. The 4th and 5th-level keywords in the commands denote the statistical result which the limit refers to:

`RPEak:CURRent`	Peak ACLR of the current slot
`RRMS:CURRent`	RMS-averaged ACLR of the current slot
`RRMS:AVERage`	RMS-averaged ACLR, averaged over several slots

CONFigure:SPECtrum:MFILter:RELative:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:ENABle *<Enable>*

Enable Relative Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check in channel <nr>	ON	–	V3.00

Description of command

This command switches the relative limit check in a particular channel <nr> on or off. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The relative limits are defined by the `CONFigure:SPECtrum:MFILter:RPEak...VALue` and `CONFigure:SPECtrum:MFILter:RRMS...VALue` commands; see above.

Note: Switching off the relative limit check also disables the absolute limit check.

CONFigure:SPECtrum:MFILter:APEak:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<ACLR_Limit>*
CONFigure:SPECtrum:MFILter:ARMS:CURRent:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<ACLR_Limit>*
CONFigure:SPECtrum:MFILter:ARMS:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<ACLR_Limit>*

Absolute Limits

<ACLR_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33.0 dBm	Absolute limit for the ACLR	–50	dBm	V3.00

Description of command

These commands define absolute limits for the ACLR. If the ACLR in all channels is below the absolute limits, the ACLR measurement will pass the limit check, irrespective of the relative limits.

CONFigure:SPECtrum:MFILter:ABSolute:LIMit[:SCALar]:
ASYMmetric:UPPer:ENABle *<Enable>*

Enable Absolute Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.00

Description of command

This command switches the absolute limit check in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:MFILter:APEak... VALue` and `CONFigure:SPECtrum:MFILter:ARMS...VALue` commands; see above.

DEFault:SPECtrum:MFILter:LIMit *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SPECTrum:MFILter:MEASx

The subsystem *SPECtrum:MFILter:MEASx* determines at which channels and frequencies the *ACLR Filter* measurement is performed. The subsystem corresponds to the *Meas. X* tab of the popup menu *Spectrum Configuration.*

Measure Points Enable

CONFigure:SPECtrum:MFILter:MEASx:CHANnel<nr>:ENABle *<Enable>*

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable the measurement in channel <nr>	ON	–	V3.00

Description of command

This command switches the measurement in a particular channel on or off. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The fixed channel frequency is the channel number times 5 MHz from the carrier frequency.

DEFault:SPECtrum:MFILter:MEASx *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem SPECtrum:MFILter?

The subsystem *SPECtrum:MFILter* measures and returns the ACLR and compares it with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum*.

Scalar Results

READ[:SCALar]:SPECtrum:MFILter:ABSolute?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFILter:ABSolute?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFILter:ABSolute?	Read measurement results (synchronized)
READ[:SCALar]:SPECtrum:MFILter:RELative?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFILter:RELative?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFILter:RELative?	Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Carrier Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Carrier Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
ACLR (Peak): Current (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (RMS): Current (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (RMS): Average (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (Peak): Maximum (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
ACLR (RMS): Maximum (x4),	–100.0 dB to 0.0 dB	NAN	dB/dBm	
UE Power (Current),	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0% to +100.0%	NAN	%	

Description of command

These commands are always queries. They start a `SPECtrum:MFILter` measurement (`READ...`) and/or return all (scalar) measurement results. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4). The keywords ABSolute and RELative in the commands distinguish whether the ACLR results are expressed in absolute units (adjacent channels powers in dBm with a value range between –100.0 dBm and +60.0 dBm) or in relative units (ACLR in dB in the value range quoted above).

CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMit?				Limit Matching
Returned values	Value range	Def. value	Def. unit	FW vers.
ACLR (Peak): Current (x4), **ACLR (Peak): RMS (x4),** **ACLR (RMS): Average (x4),** **ACLR (Peak): Maximum (x4),** **ACLR (RMS): Maximum (x4)**	For all measured values: NMAU | NMAL | INV | OK	INV INV INV INV INV	– – – – –	V3.00
Description of command				

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4).

The following messages may be returned for all measured values:

NMAU *not matching, underflow*	Underflow of tolerance value
NMAL *not matching, overflow*	Tolerance value exceeded
INV *invalid*	Measurement invalid
OK	Result within the tolerance

SPECtrum:MFFT

The subsystem `SPECtrum:MFFT` determines the Adjacent Channel Leakage power Ratio (ACLR) in frequency domain using a Fast Fourier Transform (FFT) and derives the Occupied Bandwidth (OBW). The subsystem corresponds to the measurement menu *Spectrum,* application *ACLR FFT/OBW,* and the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR FFT/OBW* application.

Control of Measurement – Subsystem SPECtrum:MFFT

The subsystem *SPECtrum:MFFT* controls the *Spectrum* measurement. It corresponds to the *ACLR FFT/OBW* softkey in the measurement menu *Spectrum.*

INITiate:SPECtrum:MFFT	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:MFFT	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:MFFT	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:MFFT	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:SPECtrum:MFFT:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.00
SOPC |	Single operation complete			
SRSQ |	SRQ and SOPC			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:SPECtrum:MFFT:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Spectrum* measurement. They correspond to the sections in the popup menu *Spectrum Configuration* that are related to the *ACLR FFT/OBW* application..

Subsystem SPECTrum:MFFT:CONTrol

The subsystem *SPECtrum:MFFT:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:MFFT:CONTrol:RMODe *<Mode>* Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	V3.00
ARRay,	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:SPECtrum:MFFT:CONTrol:STATistics *<Statistics>* Measurement Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	V3.00
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:SPECtrum:MFFT:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP |	Interrupt measurement after each statistics cycle	NONE	–	V3.00
NONE	Continue measurement according to its rep. mode			

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:SPECtrum:MFFT:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
320| 640 | 1280 | 2560	Number of chip periods measured	640	(chips)	V3.00

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement time but does not restrict the display range for the results in the frequency domain.

DEFault:SPECtrum:MFFT:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SPECTrum:MFFT:...LIMit

The subsystem *SPECtrum:MFFT:...LIMit* defines the limits for the *ACLR FFT/OBW* measurement. The subsystem corresponds to the *ACLR FFT/OBW* section in the *Limits* tab of the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:MFFT:RELative:CMAX:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue *<ACLR_Limit>*
CONFigure:SPECtrum:MFFT:RELative:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:VALue *<ACLR_Limit>* Relative ACLR Limits

<nr>	Description of parameters	Def. value	Def. unit	
1 | 2 | 3 | 4	Channel number;	–	–	
<ACLR_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dB to 0.0 dB **–80.0 dB to 0.0 dB**	Upper limit for the ACLR if <nr> = ±2 Upper limit for the ACLR if <nr> = ±1	–43 –33	dBc dBc	V3.00

Description of command

These commands define upper limits for the ACLR determined via FFT. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The channel frequency is <nr> * 5 MHz from the carrier frequency. The 5th-level keywords distinguish the limits for the *Current* and *Maximum* display modes `(CMAX)` and for the *Average* display mode `(AVERage)`.

CONFigure:SPECtrum:MFFT:RELative:LIMit[:SCALar]:
ASYMmetric:UPPer:CHANnel<nr>:Enable *<Enable>* Enable Relative ACLR Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check in channel <nr>	ON	–	V3.00

Description of command

This command switches the relative limit check in a particular channel <nr> on or off. The numeric suffix <nr> = 1, 2, 3, 4 denotes the channel numbers –2, –1, 1, 2. The relative limits are defined by the `CONFigure:SPECtrum:MFFT:RELative...VALue` commands; see above.

Note: Switching off the relative limit check also disables the absolute limit check.

CONFigure:SPECtrum:MFFT:OBW:CMAX:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<OBW_Limit>*
CONFigure:SPECtrum:MFFT:OBW:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<OBW_Limit>*

OBW Limits

<OBW_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.00 MHz to 10.00 MHz	Upper limit for the OBW	5.00	MHz	V3.00

Description of command

These commands define upper limits for the OBW determined via FFT. The 5th-level keywords distinguish the limits for the *Current* and *Maximum* display modes `(CMAX)` and for the *Average* display mode `(AVERage)`.

CONFigure:SPECtrum:MFFT:OBW:LIMit[:SCALar]:
ASYMmetric:UPPer:Enable *<Enable>*

Enable OBW Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check in channel <nr>	ON	–	V3.00

Description of command

This command switches the relative limit check in a particular channel <nr> on or off. The relative limits are defined by the `CONFigure:SPECtrum:MFFT:OBW...VALue` commands; see above.

CONFigure:SPECtrum:MFFT:ABSolute:CMAX:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<ACLR_Limit>*
CONFigure:SPECtrum:MFFT:ABSolute:AVERage:LIMit[:SCALar]:
ASYMmetric:UPPer:VALue *<ACLR_Limit>*

Absolute ACLR Limits

<ACLR_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33.0 dBm	Absolute limit for the ACLR	–50	dBm	V3.00

Description of command

These commands define absolute limits for the ACLR. If the ACLR in all channels is below the absolute limits, the ACLR measurement will pass the limit check, irrespective of the relative limits. The 5th-level keywords distinguish the limits for the *Current* and *Maximum* display modes `(CMAX)` and for the *Average* display mode `(AVERage)`.

CONFigure:SPECtrum:MFFT:ABSolute:LIMit[:SCALar]:
ASYMmetric:UPPer:Enable *<Enable>*

Enable Absolute ACLR Limits

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.00

Description of command

This command switches the absolute limit check in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:MFFT:ABSolute... VALue` commands; see above.

DEFault:SPECtrum:MFFT:LIMit *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SUBarrays:SPECtrum

The subsystem *SUBarrays:SPECtrum* defines the measurement range and the type of output values.

CONFigure:SUBarrays:SPECtrum:MFFT:WFSPectrum Definition of Subarrays
<Mode>,<Start_WFSP>,<Samples_WFSP>{,<Start_WFSP>,<Samples_WFSP>}
CONFigure:SUBarrays:SPECtrum:MFFT:WFSSpectrum
<Mode>,<Start_WFSS>,<Samples_WFSS>{,<Start_WFSS>,<Samples_WFSS>}

<Mode>	Description of parameters	Def. value	Def. unit	
ALL | **ARIThmetical |** **MINimum |** **MAXimum,**	Return all measurement values Return arithm. mean value in every range Return minimum value in every range Return maximum value in every range	ALL	–	
<Start_WFSP>	Description of parameters	Def. value	Def. unit	
–10.12 MHz to +10.12 MHz,	Start frequency for the RRC-filtered FFT curve	–10.12	MHz	
<Samples_WFSP>	Description of parameters	Def. value	Def. unit	
1 to 1013	Number of samples in current range	1013	–	
<Start_WFSS>	Description of parameters	Def. value	Def. unit	
–12.5 MHz to +12.48 MHz,	Start frequency for the raw FFT curve	–12.5	MHz	
<Samples_WFSS>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1250	Number of samples in current range	1250	–	V3.00

Description of command

These commands configure the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays:SPECtrum...` commands. They restrict the measurement to up to 32 subranges where either all measurement results (the number of which is given by the second numerical parameter) or a single statistical value is returned. The subranges are defined by the start frequency and the number of test points which are located on a fixed, equidistant grid with a step width of 20 kHz.

The subranges may overlap but must be within the total display range of the two measurement curves. Test points outside this range are not measured (result *NAN)* and do not enter into the `ARIThmetical`, `MINimum` and `MAXimum` values. The display range for the RRC-filtered FFT curve (waveform spectrum, keyword `WFSPectrum`) is smaller than the display range for the raw FFT curve (waveform signal spectrum, keyword `WFSSpectrum`).

By default, only one range corresponding to the total display range is used and all measurement values are returned.

Measured Values – Subsystem SPECtrum:MFFT?

The subsystem *SPECtrum:MFFT...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum,* application *ACLR FFT/OBW.*

Scalar Results

READ[:SCALar]:SPECtrum:MFFT:ABSolute?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFFT:ABSolute?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFFT:ABSolute?	Read measurement results (synchronized)
READ[:SCALar]:SPECtrum:MFFT:RELative?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:MFFT:RELative?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:MFFT:RELative?	Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Carrier Power (Peak): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Carrier Power (RMS): Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	
ACLR (RMS): Current (x4),	–100.0 dB to 0.0 dB	NAN	dB	
ACLR (RMS): Average (x4),	–100.0 dB to 0.0 dB	NAN	dB	
ACLR (RMS): Maximum (x4),	–100.0 dB to 0.0 dB	NAN	dB	
OBW Current,	0.00 MHz to 10.00 MHz	NAN	Hz	
OBW Average,	0.00 MHz to 10.00 MHz	NAN	Hz	
OBW Maximum,	0.00 MHz to 10.00 MHz	NAN	Hz	
OBW left,	–5.00 MHz to +5.00 MHz	NAN	Hz	
OBW right,	–5.00 MHz to +5.00 MHz	NAN	Hz	
UE Power (Current),	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0% to +100.0%	NAN	%	

Description of command

These commands are always queries. They start a `SPECtrum:MFFT` measurement (`READ...`) and/or return all (scalar) measurement results. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4). The keywords ABSolute and RELative in the commands distinguish whether the ACLR results are expressed in absolute units (adjacent channels powers in dBm with a value range between –100.0 dBm and +60.0 dBm) or in relative units (ACLR in dB in the value range quoted above). All frequency (OBW) values are expressed in Hz and in exponential representation, e.g. `4.060000E+006`.

CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
ACLR (RMS): Current (x4),	For all measured values: NMAU | NMAL | INV | OK	INV	–	V3.00
ACLR (RMS): Average (x4),		INV	–	
ACLR (RMS): Maximum (x4),		INV	–	
OBW Current,		INV	–	
OBW Average,		INV	–	
OBW Maximum		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits for the scalar measured values (see commands above) are exceeded. The symbol (x4) behind a value indicates that the list contains four results corresponding to the channel nos. –2, –1, +1, +2 (<nr> = 1, 2, 3, 4).

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

READ:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent? ACLR Curves
READ:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?
READ:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?
READ:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?
FETCh:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?
SAMPle:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for ACLR	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	nth value for ACLR	NAN	dB	

Description of command

These commands are always queries. They return the ACLR at fixed, equidistant test points with a 20 kHz raster. The number n of measured values for the RRC-filtered FFT curve (waveform spectrum, keyword `WFSPectrum`, n = 1013, frequency range from –10.12 MHz to + 10.12 MHz) is smaller than the number of values for the raw FFT curve (waveform signal spectrum, keyword `WFSSpectrum`, n = 1250, frequency range from –12.50 MHz to + 12.48 MHz).

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*). The raw FFT curve is available in *Current* mode only.

READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent? Subarray Results
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?
READ:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?
Start single shot measurement and return results ⇒ *RUN*
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?
FETCh:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read meas. results (unsynchronized) ⇒ *RUN*
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent? **SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?**
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?
SAMPle:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?
Read results (synchronized) ⇒ *RUN*

Ret. values per subrange	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for ACLR	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	nth value for ACLR	NAN	dB	

Description of command

These commands are always queries. They measure and return the ACLR in the subranges defined by means of the `CONFigure:SUBarrays:SPECtrum:MFFT...` commands. In the default setting of the configuration command the `READ:SUBarrays...`, `FETCh:SUBarrays...`, and `SAMPle:SUBarrays...` command group is equivalent to the `READ:ARRay...`, `FETCh:ARRay...`, and `SAMPle:ARRay...` command group described above.

The `CONFigure:SUBarrays:SPECtrum:MFFT...` commands define a maximum of 32 subranges. If one of the statistical modes `(ARIThmetical, MINimum, MAXimum)` is set, only one value is returned per subrange.

The calculation of *Current, Average, and MMAX* (Max./Min.) results is explained in Chapter 3 (see *display mode*).

SPECtrum:EMASk

The subsystem `SPECtrum:EMASk` determines the spectrum emissions using a Fast Fourier Transform (FFT) method. The subsystem corresponds to the measurement menu *Spectrum*, application *Emission Mask*, and the sections in the popup menu *Spectrum Configuration* that are related to the *Emission Mask* application.

Control of Measurement – Subsystem SPECtrum:EMASk

The subsystem *SPECtrum:EMASk* controls the *Spectrum* measurement. It corresponds to the *Emission Mask* softkey in the measurement menu *Spectrum*.

INITiate:SPECtrum:EMASk	Start new measurement	⇒	*RUN*
ABORt:SPECtrum:EMASk	Abort running measurement and switch off	⇒	*OFF*
STOP:SPECtrum:EMASk	Stop measurement after current stat. cycle	⇒	*STOP*
CONTinue:SPECtrum:EMASk	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:SPECtrum:EMASk:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00

Description of command
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:SPECtrum:EMASk:STATus? Measurement Status

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
OFF | **RUN |** **STOP |** **ERR |** **STEP |** **RDY,**	Measurement in the *OFF* state (`*RST` or `ABORt`) Running (after `INITiate, CONTinue` or `READ`) Stopped (`STOP`) *OFF* (could not be started) Stepping mode *(<stepmode>=STEP)* Stopped according to repetition mode and stop condition	OFF	–	V3.00
	Counter for current statistics cycle			
1 to 10000 | **NONE,**	No counting mode set	NONE	–	–
	Counter for current evaluation period within a cycle			
1 to 1000 | **NONE**	Statistic count set to off	NONE	–	V3.00

Description of command
This command is always a query. It returns the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Spectrum – Emission Mask* measurement. They correspond to the sections in the popup menu *Spectrum Configuration* that are related to the *Emission Mask* application.

Subsystem SPECTrum:EMASk:CONTrol

The subsystem *SPECtrum:EMASk:CONTrol* configures the scope of the measurement. It corresponds to the *Control* tab in the popup menu *Spectrum Configuration*.

CONFigure:SPECtrum:EMASk:CONTrol:RMODe *<Mode>*				Result Mode
<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay,**	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARR	–	V3.00
Description of command				
This command specifies the type of measured values.				

CONFigure:SPECtrum:EMASk:CONTrol:STATistics *<Statistics>*				Measurement Statistics
<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 | **NONE**	Number of evaluation periods per statistics cycle Statistics off (equivalent to 1)	10	–	V3.00
Description of command				
This command defines the number of slots forming a statistics cycle.				

CONFigure:SPECtrum:EMASk:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*				Test Cycles
<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00
Description of command				
This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement. **Note:** In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.				

CONFigure:SPECtrum:EMASk:CONTrol:MLENgth *<Length>* Measurement Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
320| 640 | 1280 | 2560	Number of chip periods measured	640	(chips)	V3.00

Description of command

This command selects the time interval to be measured. A small measurement length accelerates the measurement time.

DEFault:SPECtrum:EMASk:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem SPECTrum:EMASk:...LIMit:LINE

The subsystem *SPECtrum:EMASk:...LIMit:LINE* defines tolerance values for the *Emission Mask* measurement. The subsystem corresponds to the *Emission Mask* section in the *Limits* tab of the popup menu *Spectrum Configuration.*

CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:VALue *<Limit>* Relative Limit Lines
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:
SYMmetric:[COMBined]:VALue *<Limit>*

<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–90.0 dB to 0.0 dB	Relative limit at point A	–49	dB	V3.00
–90.0 dB to 0.0 dB	Relative limit at point B	–49	dB	
–90.0 dB to 0.0 dB	Relative limit at point C	–39	dB	
–90.0 dB to 0.0 dB	Relative limit at point D	–35	dB	
–90.0 dB to 0.0 dB	Relative limit at point E	–49.775	dB	
–90.0 dB to 0.0 dB	Relative limit at point F	–35.225	dB	

Description of command

These commands define relative limits for the *Current* and *Maximum* spectrum emission curve (5th level keyword `CMAX`) and for the *Average* curve `(AVERage)`.

CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:LIAD:ENABle *<Enable>*
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:
SYMmetric:[COMBined]:LIAD:ENABle *<Enable>*
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:LIEF:ENABle *<Enable>*
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE:
SYMmetric:[COMBined]:LIEF:ENABle *<Enable>*

Enable Relative Limit Check

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable relative limit check	ON	–	V3.00

Description of command

These commands switch the relative limit check in the different sections of the emission mask on or off. The keywords `LIAD` and `LIEF` denote the sections *Limit A-D* and *Limit E-F*, respectively. The relative limits are defined by the `CONFigure:SPECtrum:EMASk:RELative... VALue` commands; see above.

Note: Switching off the relative limit check also disables the absolute limit check.

CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:VALue
***<Limit>*CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE:**
SYMmetric:[COMBined]:VALue *<Limit>*

Absolute Limit Lines (Limit G)

<Limit>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33 dBm	Absol. limit referenced to a 3.84 MHz filter	–50	dBm	V3.00

Description of command

These commands define the absolute limit G for the *Current* and *Maximum* spectrum emission curve (5th level keyword `CMAX`) and for the *Average* curve (`AVERage`).

CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:ENABle *<Enable>*
CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE:
SYMmetric:[COMBined]:ENABle *<Enable>*

Enable Absolute Limit Check (Limit G)

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.00

Description of command

These commands switch the absolute limit check for limit G in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:EMASk:ABSolute... VALue` commands; see above.

CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE:
SYMmetric:[COMBined]:VALue *<Limit_1MHz>*,
***<Limit_30kHz>*CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE:**
SYMmetric:[COMBined]:VALue *<Limit_1MHz>*, *<Limit_30kHz>*

Absolute Limit Lines (Limit H)

<Limit_1MHz>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33 dBm,	Absol. limit H referenced to a 1 MHz filter	–13	dBm	V3.50
<Limit_30kHz>	Description of parameters	Def. value	Def. unit	FW vers.
–80.0 dBm to +33 dBm	Absol. limit H referenced to a 30 kHz filter	–15	dBm	V3.50

Description of command

These commands define the absolute limit H (additional requirement for band II) for the *Current* and *Maximum* spectrum emission curve (5th level keyword `CMAX`) and for the *Average* curve (`AVERage`). The limit is only valid for band II.

CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE:SYMmetric:[COMBined]:ENABle <*Enable*>
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE:SYMmetric:[COMBined]:ENABle <*Enable*>

Enable Absolute Limit Check (Limit H)

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable or disable absolute limit check	ON	–	V3.50

Description of command

These commands switch the absolute limit check for limit H in all channels on or off. The absolute limits are defined by the `CONFigure:SPECtrum:EMASk:ADDition... VALue` commands; see above.

DEFault:SPECtrum:EMASk:LIMit:LINE <*Enable*>

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem SPECtrum:EMASk?

The subsystem *SPECtrum:EMASk...?* measures and returns the results and compares them with tolerance values. The subsystem corresponds to the graphical measurement menu *Spectrum*, application *Emission Mask*.

Scalar Results

READ[:SCALar]:SPECtrum:EMASk?	Start single shot measurement and return results
FETCh[:SCALar]:SPECtrum:EMASk?	Read measurement results (unsynchronized)
SAMPle[:SCALar]:SPECtrum:EMASk?	Read measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
Ref. Power Current,	–100.0 dBm to +60.0 dBm	NAN	dBm	V3.00
Ref. Power Average,	–100.0 dBm to +60.0 dBm	NAN	dBm	
Ref. Power Maximum,	–100.0 dBm to +60.0 dBm	NAN	dBm	
UE Power (Current),	–100.0 dBm to +60.0 dBm	NAN	dBm	
Out of Tolerance	0% to +100.0%	NAN	%	

Description of command

These commands are always queries. They start a `SPECtrum:EMASk` measurement (`READ...`) and/or return all (scalar) measurement results.

*) The *Ref. Power Average* and *Ref. Power Max.* values are available for firmware version ≥3.07.

Spectrum Emission Curves

READ:ARRay:SPECtrum:EMASk:CURRent?
READ:ARRay:SPECtrum:EMASk:AVERage?
READ:ARRay:SPECtrum:EMASk:MAXimum?
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:SPECtrum:EMASk:CURRent?
FETCh:ARRay:SPECtrum:EMASk:AVERage?
FETCh:ARRay:SPECtrum:EMASk:MAXimum?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:SPECtrum:EMASk:CURRent?
SAMPle:ARRay:SPECtrum:EMASk:AVERage?
SAMPle:ARRay:SPECtrum:EMASk:MAXimum?
Read measurement results (synchronized) ⇒ *RUN*

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100.0 dB to 0.0 dB,	1st value for spectrum emission	NAN	dB	V3.00
... ,	...	...	...	
–100.0 dB to 0.0 dB	nth value for spectrum emission	NAN	dB	

Description of command

These commands are always queries. They return the spectrum emission at fixed test points. The array contains 1340 values and is divided into three domains with different sampling intervals:

- The values no. 1 to 321 correspond to test points that are separated by 25 MHz and cover the frequency range between –12.000 MHz and –4.000 from the carrier.
- The values no. 322 to 1019 correspond to test points that are separated by 10 MHz and cover the frequency range between –3.485 MHz and +3.485 from the carrier.
- The values no. 1020 to 1340 correspond to test points that are separated by 25 MHz and cover the frequency range between +4.000 and +12.000 MHz from the carrier.

The calculation of *Current, Average, and Maximum* results is explained in Chapter 3 (see *display mode*).

CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATChing:LIMit? Limit Matching
CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATChing:LIMit?
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATChing:LIMit?

Returned values	Value range	Def. value	Def. unit	FW vers.
Section AB,	For all measured values: NMAU | NMAL | INV | OK	INV	–	V3.00
Section BC,		INV	–	
Section CD,		INV	–	
Section EF,		INV	–	
Section FE,		INV	–	
Section DC,		INV	–	
Section CB		INV	–	
Section BA		INV	–	

Description of command

This command is always a query. It indicates whether and in which way the error limits in all areas of the spectrum emission mask (see commands above) are exceeded. Section AB denotes the frequency domain between points A and B; see section *Subsystem SPECTrum:EMASk:...LIMit:LINE* on p. 6.94 ff.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

CDPower Measurements

The subsystem *CDPower* measures the relative power and the waveform quality (ρ factor) in the individual code or physical channels of an uplink WCDMA signal. The subsystem corresponds to the measurement menu *Code Domain Power* with its various applications and the associated popup menu *Code Domain Power Configuration.*

The occupied channels can be either determined automatically or explicitly reported to the CMU. In manual control, these two channel search modes correspond to the *CDP/Code...Auto* and *CDP/Code...Manual* applications of the *Code Domain Power* measurement. In remote control, the channel search modes are distinguished by the third/fourth-level keywords in the `CDPower` commands:

- The third/fourth-level keywords `AUTomatic` and `RAUTomatic` denote the *CDP/Code Auto* and *CDP/Code Rho Auto* applications.
- The third/fourth-level keywords `MANual` and `RMANual` denote the *CDP/Code Manual* and *CDP/Code Rho Manual* applications.

The command syntax is similar for applications with the same channel search mode, so they will be described in common sections.

Note: *The equivalence of channelization code modes and* `CDPower` *applications differs from the* `MODulation:...WCDMa` *measurements where the channelization code mode is defined as a parameter (see* `CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode` *command on p.* 6.49*.*

CDPower:AUTomatic and CDPower:RAUTomatic

The subsystems *CDPower:AUTomatic* and *CDPower:RAUTomatic* measure the code domain power and CD-ρ factor in the code domain channels contributing to an uplink WCDMA signal. The subsystem corresponds to the measurement menu *Code Domain Power,* applications *CDP/Code Auto* and *CDP/Code Rho Auto,* and the sections in the popup menu *Code Domain Power Configuration* that are related to the *CDP/Code...Auto* applications.

Control of Measurement – Subsystems CDPower:AUTomatic and CDPower:RAUTomatic

The subsystems *CDPower:AUTomatic* and *CDPower:RAUTomatic* control the code domain power measurement. They correspond to the softkeys *CDP/Code Auto* and *CDP/Code Rho Auto* in the measurement menu *Code Domain Power*.

INITiate:CDPower:AUTomatic	Start new measurement	⇒ *RUN*
ABORt:CDPower:AUTomatic	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:AUTomatic	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:AUTomatic	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:CDPower:RAUTomatic	Start new measurement	⇒ *RUN*
ABORt:CDPower:RAUTomatic	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:RAUTomatic	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:RAUTomatic	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the code domain power measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:CDPower:AUTomatic:EREPorting <*Mode*>
CONFigure:CDPower:RAUTomatic:EREPorting <*Mode*>

Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:AUTomatic:STATus?
FETCh:CDPower:RAUTomatic:STATus?

Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate`, `CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE		NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Code Domain Power* measurement. They correspond to the sections in the *Code Domain Power Configuration* menu that are related to the *CDP/Code Auto* and *CDP/Code Rho Auto* applications.

Subsystems CDPower:AUTomatic:CONTrol and CDPower:RAUTomatic:CONTrol

The subsystems *CDPower:AUTomatic:CONTrol* and *CDPower:RAUTomatic:CONTrol* configure the scope of the code domain power measurement. They correspond to the *Control* tab in the popup menu *Code Domain Power Configuration.*

CONFigure:CDPower:AUTomatic:CONTrol:RMODe <*Mode*>
CONFigure:CDPower:RAUTomatic:CONTrol:RMODe <*Mode*>

Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar | **ARRay**	Scalar values only (incl. limit matching) Scalar measured values and arrays	ARR	–	V3.00

Description of command

This command specifies the type of measured values.

CONFigure:CDPower:AUTomatic:CONTrol:REPetition *<Repetition>,<Stepmode>*
CONFigure:CDPower:RAUTomatic:CONTrol:REPetition *<Repetition>,<Stepmode>*

Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 10000,	Multiple measurement (*counting*, until `Status = STEP | RDY`)			

<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP |	Interrupt measurement after each statistics cycle	NONE	–	V3.00
NONE	Continue measurement according to its rep. mode			

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:CDPower:AUTomatic:CONTrol:DSFactor *<Factor>*
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor *<Factor>*

Display Spreading Factor

<Factor>	Description of parameters	Def. value	Def. unit	FW vers.
AUTO |	Automatic detection the spreading factor	AUTO	–	V3.00
4 | 8 | 16 | 32 | 64 | 128 | 256	Explicit setting of the spreading factor of the WCDMA uplink signal			

Description of command

This command determines the display spreading factor of the WCDMA uplink signal. The display spreading factor defines the length of the output arrays of the commands *`READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?`* etc. (see p. 6.102).

DEFault:CDPower:AUTomatic:CONTrol *<Enable>*
DEFault:CDPower:RAUTomatic:CONTrol *<Enable>*

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystems CDPower:AUTomatic and CDPower:RAUTomatic?

The subsystems *CDPower:AUTomatic* and *CDPower:RAUTomatic* measure and return the code domain power parameters. The subsystems correspond to the various output elements in the measurement menu *CDPower*, applications *CDP/Code Auto* and *CDP/Code Rho Auto.*

	Scalar Results:
READ[:SCALar]:CDPower:AUTomatic? **READ[:SCALar]:CDPower:RAUTomatic?**	Start single shot measurement and return results
FETCh[:SCALar]:CDPower:AUTomatic? **FETCh[:SCALar]:CDPower:RAUTomatic?**	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:CDPower:AUTomatic? **SAMPle[:SCALar]:CDPower:RAUTomatic?**	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (RMS) Current,	0.0 % to 100.0 %	NAN	%	V3.00
I/Q Origin Offset Current,	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error Current,	–500.0 Hz to +500.0 Hz	NAN	Hz	
UE Power Current,	–100.0 dBm to +60 dBm	NAN	dBm	
Slot Number	0 to 14	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:AUTomatic` or `CDPower:RAUTomatic` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4).

READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent? CDP and CD-ρ Bar Graphs
READ:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?
READ:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?
READ:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?
Start single shot measurement and return results ⇒ *RUN*
FETCh:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?
FETCh:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?
FETCh:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?
FETCh:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?
Read measurement results (unsynchronized) ⇒ *RUN*
SAMPle:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?
SAMPle:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?
SAMPle:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?
SAMPle:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?
Read measurement results (synchronized) ⇒ *RUN*

Returned values, AUTomatic	Description of parameters	Def. value	Def. unit	
–100.0 dB to +100.0 dB,	Code domain power in first code channel	NAN	dB	
... ,	...	...	...	
–100.0 dB to +100.0 dB	Code domain power in last code channel	NAN	dB	

Returned values, RAUTomatic	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000,	CD-ρ in first code channel	NAN	–	V3.00
... ,	...	...	...	
0.0000 to +1.0000	CD-ρ in last code channel	NAN	–	

Description of command

These commands are always queries. They start a `CDPower:AUTomatic` or `CDPower:RAUTomatic` measurement `(READ...)` and/or return the CDP and CD-ρ in all code domain channels that may contribute to the WCDMA signal. The channels of the I and Q branches are returned separately (keywords `ISIGnal` and `QSIGnal)`. The total number of code channels is given by the display spreading factor set via `CONFigure:CDPower:AUTomatic:CONTrol:DSFactor` etc. (see p. 6.101) or via `CONFigure:UECode:DPDCh:AUTO:SRATe` if the `DSFactor` is set to `AUTO`.

The calculation of *Current, Average, Maximum* and *Minimum* results is explained in Chapter 3 (see *display mode*).

CDPower:MANual and CDPower:RMANual

The subsystems *CDPower:MANual* and *CDPower:RMANual* measure the code domain power and CD-ρ factor in the physical channels contributing to an uplink WCDMA signal. The subsystem corresponds to the measurement menu *Code Domain Power,* applications *CDP/Code Manual* and *CDP/Code Rho Manual,* and the sections in the popup menu *Code Domain Power Configuration* that are related to the *CDP/Code...Manual* applications.

Control of Measurement –
Subsystems CDPower:MANual and CDPower:RMANual

The subsystems *CDPower:MANual* and *CDPower:RMANual* control the code domain power measurement. They correspond to the softkeys *CDP/Code Manual* and *CDP/Code Rho Manual* in the measurement menu *Code Domain Power*.

INITiate:CDPower:MANual	Start new measurement	⇒ *RUN*
ABORt:CDPower:MANual	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:MANual	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:MANual	Next measurement step (only *stepping mode*)	⇒ *RUN*
INITiate:CDPower:RMANual	Start new measurement	⇒ *RUN*
ABORt:CDPower:RMANual	Abort running measurement and switch off	⇒ *OFF*
STOP:CDPower:RMANual	Stop measurement after current stat. cycle	⇒ *STOP*
CONTinue:CDPower:RMANual	Next meas. step (only *stepping mode*)	⇒ *RUN*

Description of command	FW vers.
These commands have no query form. They start and stop the code domain power measurement, setting it to the status indicated in the top right column.	V3.00

CONFigure:CDPower:MANual:EREPorting <*Mode*>
CONFigure:CDPower:RMANual:EREPorting <*Mode*>

Event Reporting

<*Mode*>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ | **SOPC |** **SRSQ |** **OFF**	Service request Single operation complete SRQ and SOPC No reporting	OFF	–	V3.00

Description of command
This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see Chapter 5 of CMU200/300 operating manual).

FETCh:CDPower:MANual:STATus?
FETCh:CDPower:RMANual:STATus?

Measurement Status

Ret. values	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.00
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current statistics cycle			
1 to 10000 |	No counting mode set			
NONE,		NONE	–	
	Counter for current evaluation period within a cycle			
1 to 1000 |	Statistic count set to off			
NONE		NONE	–	

Description of command

These commands are always queries. They return the status of the measurement (see Chapters 3 and 5 of the CMU200/300 operating manual).

Test Configuration

The commands of the following subsystems configure the *Code Domain Power* measurement. They correspond to the sections in the *Code Domain Power Configuration* menu that are related to the *CDP/Code Manual* and *CDP/Code Rho Manual* applications.

Subsystems CDPower:MANual:CONTrol and CDPower:RMANual:CONTrol

The subsystems *CDPower:MANual:CONTrol* and *CDPower:RMANual:CONTrol* configure the scope of the code domain power measurement. They correspond to the *Control* tab in the popup menu *Code Domain Power Configuration.*

CONFigure:CDPower:MANual:CONTrol:RMODe <*Mode*>
CONFigure:CDPower:RMANual:CONTrol:RMODe <*Mode*>

Result Mode

<Mode>	Desciption of parameters	Def. value	Def. unit	FW vers.
SCALar |	Scalar values only (incl. limit matching)	ARR	–	V3.00
ARRay	Scalar measured values and arrays			

Description of command

This command specifies the type of measured values.

CONFigure:CDPower:MANual:CONTrol:STATistics <*Statistics*>
CONFigure:CDPower:RMANual:CONTrol:STATistics <*Statistics*>

Measurement Statistics

<Statistics>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 1000 |	Number of evaluation periods per statistics cycle	10	–	V3.00
NONE	Statistics off (equivalent to 1)			

Description of command

This command defines the number of slots forming a statistics cycle.

CONFigure:CDPower:MANual:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>*
CONFigure:CDPower:RMANual:CONTrol:REPetition *<Repetition>,<StopCond>,<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous | **SINGleshot |** **1 to 10000**	Continuous measurement (until `STOP` or `ABORT`) Single shot measurement (until `Status = RDY`) Multiple measurement (*counting*, until `Status = STEP | RDY`)	SING	–	
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror | **NONE**	Stop measurement in case of error *(stop on error)* Continue measurement even in case of error	NONE	–	
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP | **NONE**	Interrupt measurement after each statistics cycle Continue measurement according to its rep. mode	NONE	–	V3.00

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:`...), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

DEFault:CDPower:MANual:CONTrol *<Enable>*
DEFault:CDPower:RMANual:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.00

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Tolerance values – Subsystem CDPower:..:LIMit

The subsystem *CDPower:...:LIMit* defines tolerance values for the code domain power measurement. The subsystem corresponds to the *Limits* tab in the popup menu *Code Domain Power Configuration.*

Upper Limits: Current & Max/Min

CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>
<*CDP_Limit*>
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>
<*CD-ρ_Limit*>

<*nr*>	Description of parameters	Def. value	Def. unit	
1 | **2 | 3 | 4 | 5 | 6 | 7**	Channel number for DPCCH Channel number for DPDCH1 to DPDCH6	–	–	
<*CDP_Limit*>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Upper limit for code domain power	0.0	dB	
<*CD-ρ_Limit*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to 1.0000	Upper limit for CD-ρ	1.000	–	V3.00
Description of command				
This command defines upper limits for the *Current* and *Max./Min.* results.				

Lower Limits: Current & Max/Min

CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>
<*CDP_Limit*>
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>
<*CD-ρ_Limit*>

<*nr*>	Description of parameters	Def. value	Def. unit	
1 | **2 | 3 | 4 | 5 | 6 | 7**	Channel number for DPCCH Channel number for DPDCH1 to DPDCH6	–	–	
<*CDP_Limit*>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Lower limit for code domain power	–10.0	dB	
<*CD-ρ_Limit*>	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to 1.0000	Lower limit for CD-ρ	0.1000	–	V3.00
Description of command				
This command defines lower limits for the *Current* and *Max./Min.* results.				

Upper Limits: Average

CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr> ***<CDP_Limit>***
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr> ***<CD-ρ_Limit>***

<nr>	Description of parameters	Def. value	Def. unit	
1 |	Channel number for DPCCH	–	–	
2 | 3 | 4 | 5 | 6 | 7	Channel number for DPDCH1 to DPDCH6			
<CDP_Limit>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Upper limit for code domain power	0.0	dB	
<CD-ρ_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to 1.0000	Upper limit for CD-ρ	1.000	–	V3.00

Description of command

This command defines upper limits for the *Average* results.

Lower Limits: Average

CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr> ***<CDP_Limit>***
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr> ***<CD-ρ_Limit>***

<nr>	Description of parameters	Def. value	Def. unit	
1 |	Channel number for DPCCH	–	–	
2 | 3 | 4 | 5 | 6 | 7	Channel number for DPDCH1 to DPDCH6			
<CDP_Limit>	Description of parameters	Def. value	Def. unit	
–50.0 dB to 0.0 dB	Lower limit for code domain power	–10.0	dB	
<CD-ρ_Limit>	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to 1.0000	Lower limit for CD-ρ	0.1000	–	V3.00

Description of command

This command defines lower limits for the *Average* results.

DEFault:CDPower:MANual:LIMit ***<Enable>***
DEFault:CDPower:RMANual:LIMit ***<Enable>***

Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.00
OFF	Some or all parameters differ from the default values			

Description of command

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem CDPower:MANual?

The subsystem *CDPower:MANual* measures and returns the code domain power parameters and compares them with the tolerance values. The subsystem corresponds to the various output elements in the measurement menu *CDPower,* application *CDP/Code Manual* and *CDP/Code Rho Manual.*

Scalar Results:

READ[:SCALar]:CDPower:MANual?
READ[:SCALar]:CDPower:RMANual? Start single shot measurement and return results

FETCh[:SCALar]:CDPower:MANual?
FETCh[:SCALar]:CDPower:RMANual? Read out meas. results (unsynchronized)

SAMPle[:SCALar]:CDPower:MANual?
SAMPle[:SCALar]:CDPower:RMANual? Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
EVM (RMS) Current,	0.0 % to 100.0 %	NAN	%	V3.00
I/Q Origin Offset Current,	–100.0 dB to 0.0 dB	NAN	dB	
Frequency Error Current,	–5000.0 Hz to +5000.0 Hz	NAN	Hz	
UE Power Current,	–100.0 dBm to +60 dBm	NAN	dBm	
Out of Tolerance,	0.0% to 100.0%	NAN	%	
Slot Number	0 to 14	NAN	–	V3.00

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return all scalar measurement results (see Chapter 4).

CDP and CD-ρ Bar Graphs

READ:ARRay:CDPower:MANual:CURRent?
READ:ARRay:CDPower:MANual:AVERage?
READ:ARRay:CDPower:MANual:MAXimum?
READ:ARRay:CDPower:MANual:MINimum?

READ:ARRay:CDPower:RMANual:CURRent?
READ:ARRay:CDPower:RMANual:AVERage?
READ:ARRay:CDPower:RMANual:MAXimum?
READ:ARRay:CDPower:RMANual:MINimum?
Start single shot measurement and return results ⇒ *RUN*

FETCh:ARRay:CDPower:MANual:CURRent?
FETCh:ARRay:CDPower:MANual:AVERage?
FETCh:ARRay:CDPower:MANual:MAXimum?
FETCh:ARRay:CDPower:MANual:MINimum?

FETCh:ARRay:CDPower:RMANual:CURRent?
FETCh:ARRay:CDPower:RMANual:AVERage?
FETCh:ARRay:CDPower:RMANual:MAXimum?
FETCh:ARRay:CDPower:RMANual:MINimum?
Read measurement results (unsynchronized) ⇒ *RUN*

SAMPle:ARRay:CDPower:MANual:CURRent?
SAMPle:ARRay:CDPower:MANual:AVERage?
SAMPle:ARRay:CDPower:MANual:MAXimum?
SAMPle:ARRay:CDPower:MANual:MINimum?

SAMPle:ARRay:CDPower:RMANual:CURRent?
SAMPle:ARRay:CDPower:RMANual:AVERage?
SAMPle:ARRay:CDPower:RMANual:MAXimum?
SAMPle:ARRay:CDPower:RMANual:MINimum?
Read measurement results (synchronized) ⇒ *RUN*

Returned values, MANual	Description of parameters	Def. value	Def. unit	
–100.0 dB to 0.0 dB, **–100.0 dB to 0.0 dB,** **... ,** **–100.0 dB to 0.0 dB**	Code domain power in DPCCH Code domain power in DPDCH1 ... Code domain power in DPDCH6	NAN NAN ... NAN	dB dB ... dB	
Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
0.0000 to +1.0000, **0.0000 to +1.0000,** **... ,** **0.0000 to +1.0000**	CD-ρ in DPCCH CD-ρ in DPDCH1 ... CD-ρ in DPDCH6	NAN NAN ... NAN	– – ... –	V3.00

Description of command

These commands are always queries. They start a `CDPower:MANual` or `CDPower:RMANual` measurement `(READ...)` and/or return the CDP and CD-ρ in all 7 physical channels that may contribute to the WCDMA signal.

The calculation of *Current, Average, Maximum* and *Minimum* results is explained in Chapter 3 (see *display mode*).

CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?
CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?
CALCulate:ARRay:CDPower:MANual:MAXimum:MATChing:LIMit?
CALCulate:ARRay:CDPower:MANual:MINimum:MATChing:LIMit?

CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:AVERage:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:MAXimum:MATChing:LIMit?
CALCulate:ARRay:CDPower:RMANual:MINimum:MATChing:LIMit?

Limit Matching

Returned values, MANual	Description of parameters	Def. value	Def. unit	
CDP in DPCCH **CDP in DPDCH1** **...** **CDP in DPDCH6**	For all measured values: NMAU | NMAL | INV | OK	INV INV ... INV	– – ... –	
Returned values, RMANual	Description of parameters	Def. value	Def. unit	FW vers.
CD-ρ in DPCCH **CD-ρ in DPDCH1** **...** **CD-ρ in DPDCH6**	For all measured values: NMAU | NMAL | INV | OK	INV INV ... INV	– – ... –	V3.00

Description of command

These commands are always queries. They indicate whether and in which way the error limits for the code domain power and the CD-ρ (see commands aboves) are exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow.*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Receiver Quality Measurements

The subsystem *RXQuality* comprises the commands for all receiver quality measurements. The subsystem corresponds to the main menu *Receiver Quality* and the associated popup menu *Receiver Quality Configuration.*

RXQuality:BER

The subsystem `RXQuality:BER` controls the BER, BLER and DBLER measurement. The subsystem corresponds to the measurement menu *Receiver Quality.* application *BER,* and the sections in the popup menu *Receiver Quality Configuration* that are related to the *BER* application.

Control of Measurement – Subsystem RXQuality:BER

The subsystem *RXQuality:BER* controls the receiver quality measurements.

INITiate:RXQuality:BER	Start new measurement	⇒	*RUN*
ABORt:RXQuality:BER	Abort running measurement and switch off	⇒	*OFF*
STOP:RXQuality:BER	Stop measurement	⇒	*STOP*
CONTinue:RXQuality:BER	Next measurement step (only *stepping mode*)	⇒	*RUN*

Description of command	FW vers.
These commands have no query form. They start or stop the current measurement, setting it to the status indicated in the top right column.	V3.07

CONFigure:RXQuality:BER:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.07
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).

FETCh:RXQuality:BER:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.07
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
	Counter for current evaluation period (frame)			
1 to 1000 |	Statistic count set to off (only 1 frame)	NONE	–	
NONE				

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5).

Subsystem RXQuality:BER:CONTrol

The subsystem *RXQuality:BER:CONTrol* sets the control parameters for the receiver quality measurement. The subsystem corresponds to the *Control* tab in the popup menu *Receiver Quality Configuration*.

CONFigure:RXQuality:BER:CONTrol:REPetition *<StopCondition>*,*<Stepmode>* Test Cycles

<Repetition>	Description of parameters	Def. value	Def. unit	
CONTinuous |	Continuous measurement (until `STOP` or `ABORT`)	SING	–	
SINGleshot |	Single shot measurement (until `Status = RDY`)			
1 to 1000	Multiple measurement (*counting*, until `Status = STEP | RDY`)			
<StopCond>	Description of parameters	Def. value	Def. unit	
SONerror |	Stop measurement in case of error *(stop on error)*	NONE	–	
NONE	Continue measurement even in case of error			
<Stepmode>	Description of parameters	Def. value	Def. unit	FW vers.
STEP |	Interrupt measurement after each statistics cycle	NONE	–	V3.07
NONE	Continue measurement according to its rep. mode			

Description of command

This command determines the number of statistics cycles, the stop condition and the stepping mode for the measurement.

Note: In the case of READ commands (`READ:...`), the <Repetition> parameter has no effect; the measurement is always stopped after a single shot.

CONFigure:RXQuality:BER:CONTrol:TBLocks *<Blocks>* Transport Blocks

<Blocks>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 50000 |	Transport blocks for single shot measurements	100	(blocks)	V3.07
1 to 500	Transport blocks for continuous measurements	500	(blocks)	

Description of command

This command defines the number of transport blocks to be sent per measurement cycle. The values for single shot and continuous measurements are stored as two independent variables with different default values. Which value is set and used depends on the current repetition mode; see command `CONFigure:RXQuality:BER:CONTrol:REPetition`.

CONFigure:RXQuality:BER:CONTrol:TBSize *<Symmetry>* Transport Block Size

<Symmetry>	Description of parameters	Def. value	Def. unit	FW vers.
ASYM |	DL and UL block of different size	ASYM	–	V3.07
SYMM	DL and UL block of the same size			

Description of command

This command defines whether DL and UL transport block sizes are different *(asymmetric)* or the same *(symmetric)*.

Note: *This command is available in Non Signalling mode only. In Signalling mode, the transport block size is set via* `CONFigure:BSSignal:DCH:RMC:UCRC`.

CONFigure:RXQuality:BER:CONTrol:TIMing *<Chips>* DL/UL Timing

<Symmetry>	Description of parameters	Def. value	Def. unit	FW vers.
876 to 1172	DL/UL Timing	1024	(chips)	V3.07

Description of command

This command sets the delay time (in integer chip periods) of the UL signal transmitted by the UE relative to the received DL signal from the CMU.

Note: *This command is available in Non Signalling mode only. In Signalling mode, the UE is synchronized to the BS Signal when a connection is established, so there is no need to correct the timing.*

DEFault:RXQuality:BER:CONTrol <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	V3.07

Description of command

As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Subsystem RXQuality:BER:LIMit

The subsystem *RXQuality:BER:LIMit* defines tolerance values for the receiver quality measurements. The subsystem corresponds to the *Limits* tab in the popup menu *Receiver Quality Configuration.*

CONFigure:RXQuality:BER:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:VALue Limits
<BER>, <BLER>, <DBLER>

<BER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %,	Upper limit for Bit Error Rate	0.1	%	V3.07
<BLER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %,	Upper limit for Block Error Rate	1.0	%	V3.07
<DBLER>	Description of parameters	Def. value	Def. unit	FW vers.
0 % to 100 %,	Upper limit for Data Block Error Rate	0.1	%	V3.15

Description of command

This command defines upper limits for for the three different bit error rates obtained in the *Receiver Quality* measurement.

DEFault:RXQuality:BER:LIMit <Enable> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	All parameters are set to their default values Some or all parameters differ from the default values	ON	–	V3.07

Description of command

As a *setting command* with the setting *ON* this command sets all parameters of the subsystem to default values (the setting *OFF* causes an error message). As a query, this command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.

Measured Values – Subsystem RXQuality:BER?

The subsystem *RXQuality:BER?* measures and returns the different bit error rates and compares them with the tolerance values. The subsystem corresponds to the left output table in the *Receiver Quality* menu.

Scalar Results

READ[:SCALar]:RXQuality:BER?	Start single shot measurement and return results
FETCh[:SCALar]:RXQuality:BER?	Read out meas. results (unsynchronized)
SAMPle[:SCALar]:RXQuality:BER?	Read out measurement results (synchronized)

Returned values	Value range	Def. value	Def. unit	FW vers.
BER,	0.000% to 100.000%	NAN	%	V3.07
BLER,	0.000% to 100.000%	NAN	%	
DBLER,	0.000% to 100.000%	NAN	%	
DL/UL Alignment,	0 chips to 2559 chips	NAN	(chips)	
Lost Transport Blocks	0 to <total number of blocks sent>	NAN	(blocks)	

Description of command

These commands are always queries. They start a bit-error-rate test and return the measurement results (see also detailed explanation of measured values in chapter 4). The results are

BER	Bit error rate
BLER	Block error rate
DBLER	Data block error rate
DL/UL Alignment	Measured time offset between UL and DL signal
Lost Transport Blocks	Difference between the number of blocks sent and the number of blocks received

The BLER result is not available (NAN) if a symmetric transport block size is selected (see command `CONFigure:RXQuality:BER:CONTrol:TBSize`).

CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit? Limit Matching

Returned values for BDBL	Value range	Def. value	Def. unit	FW vers.
BER,	NMAU | INV | OK	INV	–	V3.07
BLER,	NMAU | INV | OK	INV	–	
DBLER	NMAU | INV | OK	INV	–	

Description of command

This command is always a query. It indicates whether and in which way the tolerances for the bit error rate test (see command above) have been exceeded.

The following messages can be returned for the measured quantities:

NMAU	Tolerance exceeded	*not matching, underflow*
INV	Invalid measurement	*invalid*
OK	all tolerances matched	

RXQuality:UEReports

The subsystem *`RXQuality:UEReports`* controls the *UE Reports* application of the *Receiver Quality* measurement.

INITiate:RXQuality:UEReport	Start new measurement	⇒	*RUN*
ABORt:RXQuality:UEReport	Abort running measurement and switch off	⇒	*OFF*

Description of command	FW vers.
These commands have no query form. They initiate or abort the current measurement, setting it to the status indicated in the top right column.	V3.40

CONFigure:RXQuality:UEReport:EREPorting <*Mode*> Event Reporting

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
SRQ |	Service request	OFF	–	V3.40
SOPC |	Single operation complete			
SRSQ |	SRQ and SRSQ			
OFF	No reporting			

Description of command

This command defines the events generated when the measurement is terminated or stopped *(event reporting,* see chapter 5 of CMU manual).

FETCh:RXQuality:UEReport:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.40
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
NONE	Statistic count, always set to off (only 1 frame)	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5).

CONFigure:RXQuality:UEReport<nr>:ENABle <*Enable*> UE Report

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	<nr> = 1: CPICH RSCP	ON	–	V3.40
ON | OFF	<nr> = 2: CPICH E_c/I_0	ON	–	
ON | OFF	<nr> = 3: Log 10(Transport channel BLER)	ON	–	
ON | OFF	<nr> = 4: UE transmitted power	ON	–	
ON | OFF	<nr> = 5: UE RX/TX time difference	ON	–	
ON | OFF	<nr> = 6: Pathloss	ON	–	

Description of command

This command enables or disables the evaluation and display of the optional individual information elements included in the UE measurement report message. Each information element is addressed by a numeric suffix.

DEFault:RXQuality:UEReport:CONTrol *<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	All information elements are displayed At least one information element is switched off	ON	–	V3.40

Description of command

As a *setting command* with the setting *ON* this command enables the evaluation and display of all UE report information elements (see `CONFigure:RXQuality:UEReport<nr>:ENABle`). The setting *OFF* causes an error message.

As a query, this command returns whether all parameters are displayed *(ON)* or not *(OFF)*.

[SENSe:]RXQuality:UEReport<nr>? UE Report

Returned values, <nr> = 1	Description of parameters	Def. value	Def. unit	FW vers.
–116*) dBm to –25 dBm, **–115 dBm to –24**) dBm,**	Lower limit for CPICH RSCP Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.40
Returned values, <nr> = 2	Description of parameters	Def. value	Def. unit	FW vers.
–25*) dB to –0.5 dB, **–24.5 dBm to 0**) dBm,**	Lower limit for CPICH E_c/I_0 Upper limit = lower limit + 0.5 dB	NAN NAN	dB dB	V3.40
Returned values, <nr> = 3	Description of parameters	Def. value	Def. unit	FW vers.
–4.095*) to –0.065, **–4.03 to 0,**	Lower limit for Log 10(Transport ch. BLER) Upper limit ≥ lower limit	NAN NAN	– –	V3.40
Returned values, <nr> = 4	Description of parameters	Def. value	Def. unit	FW vers.
–50*) dBm to –49 dBm, **+33 dBm to +34**) dBm,**	Lower limit for UE transmitted power Upper limit = lower limit + 1 dB	NAN NAN	dBm dBm	V3.40
Returned values, <nr> = 5	Description of parameters	Def. value	Def. unit	FW vers.
767 chips to 1280 chips, **768 chips to 1281 chips,**	Lower limit for UE RX/TX time difference Upper limit = lower limit + 1 chip	NAN NAN	(chips) (chips)	V3.40
Returned values, <nr> = 6	Description of parameters	Def. value	Def. unit	FW vers.
+46*) dB to +158) dB**	Downlink pathloss	NAN	dB	V3.40

Description of command

This command is always a query. It returns the UE report results enabled by means of `CONFigure:RXQuality:UEReport<nr>:ENABle` *<Enable>*. To obtain valid results, the UE report measurement must be running (`INITiate:UEReport`).

*) The value actually corresponds to –∞. The value actually corresponds to –∞.
**) The value actually corresponds to +∞.

Connection Control (Signalling)

The remote-control commands presented in this section control the signalling procedures between the configure the RF analyzer and the generated downlink signal, determine the inputs and outputs, the reference frequency and the trigger settings. They correspond to the settings in the *Connection Control* menu.

Connection Setup – Subsystem SIGNalling

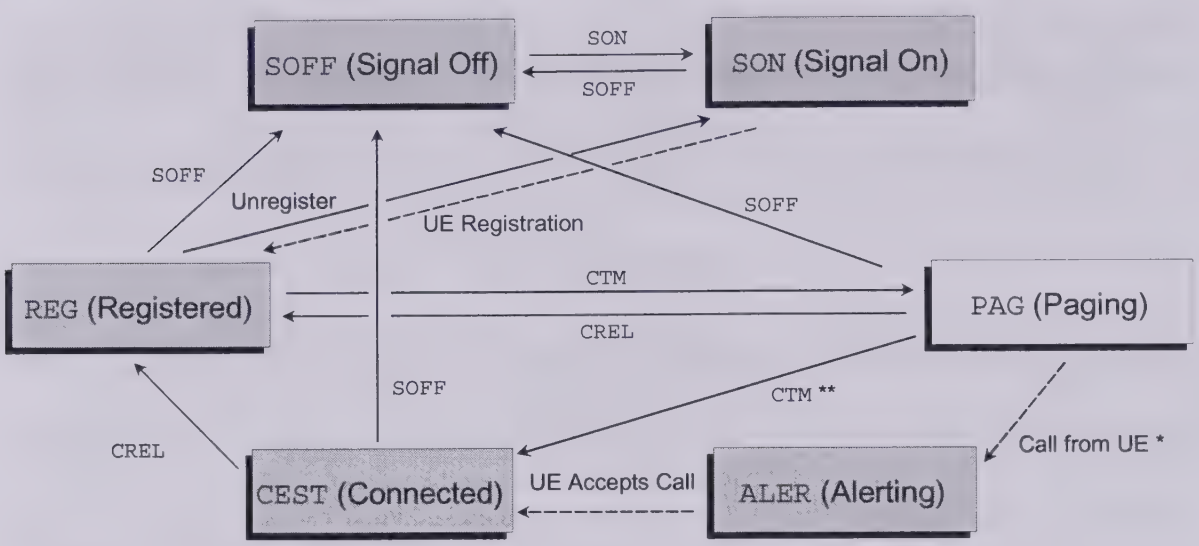
The subsystem *SIGNalling* controls the setup and release of a connection between the CMU and the UE and determines the signalling parameters. Together with the subsystem *WPOWer* it corresponds to the different *Connection* tabs (for different signalling states, see command `PROCedure:SIGNalling:ACTion`) in the popup menu *Connection Control*.

PROCedure:SIGNalling:ACTion <*Action*>				Signalling Control
<Action>	Description of parameters	Def. value	Def. unit	FW vers.
SOFF |	Switch off WCDMA signal for synchronization *(Signal Off)*	–	–	V3.15
SON |	Switch on WCDMA signal *(Signal On)*			
CTMobile |	Call To Mobile *(Connect UE)**			
UNRegister |	Unregister			
CRELease |	Call release *(Disconnect UE)*			
HANDover	Handover to GSM target network defined via `CONFigure:HANDover:TARGet` (from CONNected state)			V3.50
Description of command				Sig. State
This command has no query form. It changes between the different signalling states of the CMU. The current state can be queried via `SIGN:STAT?` `*)` A `CTM` is only allowed in `REG` state and can lead to the `ALER` or to the `CEST` state, see Fig. 1 *below.*				See below

Important Note: ***Signalling States and Local to Remote Switchover***

The default signalling state of the CMU in remote control is `SOFF` (see Fig. 1 below). This state is automatically reached on switchover from manual to remote control; an existing connection to the MS under test is dropped.

To suspend this default behavior of the CMU, the base system command `SYSTem:GTRM:COMP` has been introduced. `SYSTem:GTRM:COMP OFF` prevents the instrument from changing the signalling state local to remote switchover. In particular, an existing connection is maintained. The default behavior of the CMU is restored each time the instrument is rebooted. For more information see the documentation of the base system commands in the CMU manual.


SOFF (Signal Off)
SON
SOFF
SON (Signal On)
SOFF
Unregister
UE Registration
SOFF
REG (Registered)
CTM
CREL
PAG (Paging)
SOFF
CTM **
CREL
Call from UE *
CEST (Connected)
UE Accepts Call
ALER (Alerting)

* Not possible if `CONFigure:BSSignal:DCH:TYPE RMC` and `CONFigure:BSSignal:DCH:RMC:TMODe ON | MODE1 | MODE2`
** Only possible if `CONFigure:BSSignal:DCH:TYPE RMC` and `CONFigure:BSSignal:DCH:RMC:TMODe ON | MODE1 | MODE2`

Fig. 1 Signalling states of the CMU and transitions

Further transitions between the signalling states (not shown in Fig. 1) may occur, e.g. in case of errors. For a state diagram of handover procedures refer to chapter 4.

[SENSe:]SIGNalling:STATe? Signalling State

Return	Description of parameters	Def. value	Def. unit	FW vers.
SOFF |	Signal for synchronization switched off *(Signal Off)*	SOFF	–	V3.15
SON |	Signal for synchronization switched on *(Signal On)*			
REG |	Synchronization of CMU and registration performed *(Registered)*			
PAG |	CMU is sending paging messages to attempt a connection			
ALER |	Mobile is ringing *(Alerting)*			
CEST	Call to mobile set up *(Connected)*			

Description of command	Sig. State
This command is always a query. It returns the current signalling state. ***Note:*** *The CPEN (Call Pending) state during a WCDMA to GSM handover procedure can be queried in the GSM destination network.*	all

[SENSe:]SIGNalling:RIType? Registration Identity Type.

Return	Description of parameters	Def. value	Def. unit	FW vers.
UNKN |	Unknown RI type	NAN	–	V3.15
IMSI | IMEI | IMSISV | TMSI	Known RI types			

Description of command	Sig. State
This command is always a query. It returns the Registration Identity Type of the UE.	REG CEST

[SENSe:]SIGNalling:RIDentity?				Registration Identity
Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 18 digits>	Registration Identity	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the Registration Identity of the UE.				REG CEST

[SENSe:]SIGNalling:IMEI? IMEI				
Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 18 digits>	Intern. Mobile Equipment Id.	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the IMEI of the UE. The value is available some time after the CMU enters the *Registered* state.				REG CEST

[SENSe:]SIGNalling:DNUMber?				UE Called Number
Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 129 digits>	Dialed Number	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the number dialed at the UE.				CEST

[SENSe:]SIGNalling:CNUMber?				UE Calling Number
Return	Description of parameters	Def. value	Def. unit	FW vers.
<max. 129 digits>	UE Calling Number	NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the number dialed at the CMU to connect to the UE.				CEST

Subsystem OLP (Openloop Power)

The subsystem `OLP` controls the PRACH preamble power and signature measurement. It corresponds the the *Openloop Power* softkey in the *Connection* tab of the *Connection Control* menu.

INITiate:OLP	Start new measurement	⇒	*RUN*
ABORt:OLP	Abort running measurement and switch off	⇒	*OFF*
Description of command			FW vers.
These commands have no query form. They initiate or abort the current measurement, setting it to the status indicated in the top right column.			V3.40

FETCh:OLP:STATus? Measurement Status

Return	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	Measurement in the *OFF* state (`*RST` or `ABORt`)	OFF	–	V3.40
RUN |	Running (after `INITiate, CONTinue` or `READ`)			
STOP |	Stopped (`STOP`)			
ERR |	*OFF* (could not be started)			
STEP |	Stepping mode *(<stepmode>=STEP)*			
RDY,	Stopped according to repetition mode and stop condition			
NONE	Statistic count, always set to off (only 1 frame)	NONE	–	

Description of command

This command is always a query. It returns the status of the measurement (see chapter 5).

CONFigure:OLP:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue <Limit> Limit

<Limit	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to +15.0 dB	PRACH UE-on power limit	±9.0	dB	V3.40

Description of command

This command defines a symmetric limit for the difference between the measured initial PRACH preamble power and the expected PRACH power, to be queried via `READ[:SCALar]:OLP?` or `FETCh[:SCALar]:OLP?`

OLP Results

READ[:SCALar]:OLP? Start single shot measurement and return results
FETCh[:SCALar]:OLP? Read out meas. results (unsynchronized)

Returned values	Description of parameters	Def. value	Def. unit	FW vers.
–100 dBm to +60 dBm,	PRACH UE-On Power	NAN	dBm	V3.40
0 to 15,	PRACH signature	NAN	–	
–100 dBm to +60 dBm	Expected PRACH power	NAN	dBm	

Description of command

This command is always a query. It returns the openloop power results.

CALCulate[:SCALar]:OLP:MATChing:LIMit? Limit Matching

Returned values	Value range	Def. value	Def. unit	FW vers.
PRACH UE-On Power	NMAU | NMAL | INV | OK	INV	–	V3.40

Description of command

This command is always a query. It indicates whether and in which way the limit for the PRACH UE-on power (see command above) has been exceeded.

The following messages may be returned for all measured values:

NMAU	Underflow of tolerance value	*not matching, underflow*
NMAL	Tolerance value exceeded	*not matching, overflow*
INV	Measurement invalid	*invalid*
OK	Result within the tolerance	

Subsystem HANDover

The subsystem *HANDover* sets the target for handover of the WCDMA connection to a target GSM network. The corresponding softkeys are located in the *Handover* tab in the popup menu *Connect. Control*.

STATus:HANDover:TARGet:LIST?				Destination List
Response	Description of parameters	Def. value	Def. unit	FW vers.
"GSM400MsDualBand",	Target list (4 entries at maximum):	–	–	V3.50
"GSM850MsDualBand",		–	–	
"GSM900MsDualBand",	All installed and enabled GSM networks	–	–	
"GSM1800MsDualBand",	except the current network	–	–	
"GSM1900MsDualBand"		–	–	
Description of command				Sig. State
This command is always a query and returns a list of all networks that are available for a handover. The list depends on the software configuration and on the current network.				REG CONN

CONFigure:HANDover:TARGet *<Target>*				Destination Selection
<Target>	Description of parameters	Def. value	Def. unit	FW vers.
"GSM400MsDualBand" | **"GSM850MsDualBand" |** **"GSM900MsDualBand" |** **"GSM1800MsDualBand" |** **"GSM1900MsDualBand"**	Possible target networks	NONE	–	V3.50
NONE	No handover			
Description of command				Sig. State
This command selects a handover target. The available targets comprise all installed and enabled GSM networks. The handover itself is started via the `PROCedure:SIGNalling:ACTion HANDover` command.				REG CONN

CONFigure:HANDover:TARGet:PREPare *<Enable>*				GSM Sig. On/Off
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	GSM Sig. On	OFF	–	V3.50
OFF	GSM Sig. Off			
Description of command				Sig. State
This command loads the GSM function group and activates the *Call Pending* state from where a handover to GSM can be initiated (`PROCedure:SIGNalling:ACTion HANDover`).				REG CONN

Subsystem UECapability (Radio Access Capability)

The subsystem *UECapability* contains queries to read out the Radio Access Capability of the UE. The parameters are displayed in the *Signalling Info* table in the *Connection* popup menu *Connection Control*. The parameters are transferred during registration and available (if requested; see command `CONFigure:NETWork:REQuest:ACAPability`).

[SENSe:]UECapability:PDCP? Packet Data Convergence Protocol

Return	Description of parameters	Def. value	Def. unit	FW vers.
SUPP | NSUP |	Support of loss-less SRNS relocation	NAN,	–	V3.15
SUPP | NSUP |	Support of RFC 2507	NAN,	–	
512 | 1024 | 2048 | 4096 | 8192	Header Compression	NAN	–	
Description of command				Sig. State
This command is always a query. It returns the PCDP parameters of the UE.				REG CEST

[SENSe:]UECapability:RLC? Radio Link Control

Return	Description of parameters	Def. value	Def. unit	FW vers.
2 | 10 | 50 | 100 | 150 | 500 | 1000,	AM Buffer Size	NAN,	–	V3.15
2047 | 4095,	Max. RLC Window Size	NAN,	–	
3 | 4 | 5 | 6 | 8 | 16 | 30	Max. AM Entities	NAN	–	
Description of command				Sig. State
This command is always a query. It returns Radio Link Control parameters of the UE.				REG CEST

[SENSe:]UECapability:PDOWnlink? Physical Downlink

Return	Description of parameters	Def. value	Def. unit	FW vers.
4 | 8 | 16 | 32,	Simult. Tr. Channel, .	NAN	–	V3.15
1 to 8,	Simult. CCTr. Channel,	NAN		
4 | 8 | 16 | ... | 512,	TTI Transport Blocks,	NAN		
16 | 32 | 48 | ... | 512 | 1024,	Number of TFC,	NAN		
32 | 64 | 128 | 256 | 512 | 1024,	Number of TF,	NAN		
NSUP | SUPP,	Turbo Decoding,	NAN		
640 | 1280 | ... | 163840,	Received Bits All,)	NAN		
640 | 1280 | ... | 163840,	Received Bits Conv. Coded,	NAN		
640 | 1280 | ... | 163840,	Received Bits Turbo coded,	NAN		
	Phys Channel FDD			
1 to 8,	DPCH/PDSCH codes,	NAN		
600 | 1200 | 2400 | 3600 | 4800 | 7200 | 9600 | 14400 | 19200 | 28800 | 38400 | 48000 | 57600 | 67200 | 76800,	Physical Channel Bits,	NAN		
NSUP | SUPP,	SF512,	NAN		
NSUP | SUPP,	PDSCH,	NAN		
NSUP | SUPP,	Channel Estimation Pilots,	NAN		
	Simult. Reception			
NSUP | SUPP,	SCCPCH/DPCH,	NAN		
NSUP | SUPP,	SCCPCH/DPCH/PDSCH,	NAN		
1	SCCPCH radio links	NAN		
Description of command				Sig. State
This command is always a query. It returns the parameters of the physical downlink.				REG CEST

[SENSe:]UECapability:PUPLink? Physical Uplink

Return	Description of parameters	Def. value	Def. unit	FW vers.
4 | 8 | 16 | 32,	Simult. Tr. Channel,.	NAN	–	V3.15
1 ... 8,	Simult. CCTr. Channel,	NAN		
4 | 8 | 16 | 32 | 48 | 64 | 96 | 128 | 256 | 512,	TTI Transport Blocks,	NAN		
16 | 32 | 48 | 64 | 96 | 128 | 256 | 512 | 1024,	Number of TFC,	NAN		
32 | 64 | 128 | 256 | 512 | 1024,	Number of TF,	NAN		
NSUP | SUPP,	Turbo Encoding,	NAN		
640 | 1280 | 2560 | 3840 | 5120 | 6400 | 7680 | 8960 | 10240 | 20480 | 40960 | 81920 | 163840,	Transmitted Bits All,)	NAN		
640 | 1280 | 2560 | 3840 | 5120 | 6400 | 7680 | 8960 | 10240 | 20480 | 40960 | 81920 | 163840,	Transm Bits Conv. Coded,	NAN		
640 | 1280 | 2560 | 3840 | 5120 | 6400 | 7680 | 8960 | 10240 | 20480 | 40960 | 81920 | 163840,	Transm. Bits Turbo Coded,	NAN		
600 | 1200 | 2400 | 3600 | 4800 | 7200 | 9600 | 14400 | 19200 | 28800 | 38400 | 48000 | 57600,	DPDCH Bits per 10ms,	NAN		
NSUP | SUPP,	Ph. Channel FDD PCPCH,	NAN		
1 | 2 |3 | 4	UE Power Class	NAN		

Description of command	Sig. State
This command is always a query. It returns the parameters of the physical uplink.	REG CEST

[SENSe:]UECapability:RFParameters? RF Parameters

Return	Description of parameters	Def. value	Def. unit	FW vers.
	TX/RX frequency separation			V3.15
0 (134.8 ... 245.2 MHz) |	For Operating Band	NAN,	–	
1 (174.8 ... 205.2 MHz) |	For Operating Band	NAN,	–	
2 (190.0 MHz)	For Operating Band	NAN	–	

Description of command	Sig. State
This command is always a query. It returns Radio Link Control parameters of the UE.	REG CEST

[SENSe:]UECapability:MMODe? Multi Mode

Return	Description of parameters	Def. value	Def. unit	FW vers.
FDD |	Frequency Division Duplex	NAN	–	V3.15
TDD |	Time Division Duplex			
FTDD	FDD and TDD			

Description of command	Sig. State
This command is always a query. It returns the multi mode capability of the UE.	REG CEST

[SENSe:]UECapability:MRATe?				Multi RAT
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP, NSUP | SUPP	GSM support Multi-carrier mode support	NAN, NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns the Radio Access Technology that the UE supports.				REG CEST

[SENSe:]UECapability:UEPosition?				UE Position
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP	<Standalone Loc. Method>	NAN	–	V3.15
NBASed | UEBased | BOTH | NONE	<Network Assisted GPS>	NAN		
NSUP | SUPP	<GPS Reference Time>	NAN		
NSUP | SUPP	<IPDL>	NAN		
NSUP | SUPP	<OTDOA UE Based Method>	NAN		
NSUP | SUPP	<Rx/Tx Time Difference>	NAN		
Description of command				Sig. State
This command is always a query. It returns parameters related to UE positioning.				REG CEST

[SENSe:]UECapability:MRELated?				Measurement Related
Return	Description of parameters	Def. value	Def. unit	FW vers.
NSUP | SUPP NSUP | SUPP	<DL Compressed Mode> <UL Compressed Mode>	NAN NAN	–	V3.15
Description of command				Sig. State
This command is always a query. It returns parameters related to inter-frequency or inter-Radio Access Technology (RAT) measurements.				REG CEST

Subsystem UESignal (UE Signal)

The subsystem *UESignal* defines the properties of the uplink WCDMA signal from the UE that the CMU is able to analyze. The subsystem corresponds to the *UE Signal* tab in the popup menu *Connection Control*.

CONFigure:UESignal:CHANnel <*Number*> RF Channel Uplink

<Number>	Description of parameters	Def. value	Def. unit	FW vers.
1922.4 MHz to 1977.6 MHz (ch. no. 9612 to 9888) |	Input frequency for Op. Band I (in multiples of 200 kHz)	1922.4 (ch. no. 9613)	MHz	V3.15
1852.4 MHz to 1907.6 MHz (ch. no. 9262 to 9538) |	Input freq. for Op. Band II (in multiples of 200 kHz)	1852.6 (ch. no. 9263)	MHz	
1712.4 MHz to 1782.6 MHz (ch. no. 8562 to 8913)	Input freq. for Op. Band II (in multiples of 200 kHz)	1712.6 (ch. no. 8563)	MHz	

Description of command	Sig. State
This command defines the center frequency of the RF analyzer. With the command `CONFigure:UESignal:CHANnel:UNIT`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies follows 3GPP specifications (see Chapter 4). **Note:** *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:UES:CHAN CH` *and their channel numbers.*	all

UNIT:UESignal:CHANnel <*Unit*> Frequency Unit

<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit Channel number (UARFCN)	MHz	–	V3.15

Description of command	Sig. State
This command defines whether the frequency of the RF signal analyzed is specified in frequency units or as an UARFCN. **Note:** *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with* `UNIT:UES:CHAN CH` *and their channel numbers.*	all

CONFigure:UESignal:FOFFset <*FrequencyOffset*> Frequency Offset

<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Frequency offset	0	kHz	V3.15

Description of command	Sig. State
This command defines an offset for the RF analyzer frequency set with the command `CONFigure:UESignal:CHANnel`. The offset frequency must be in multiples of 1 Hz.	all

DEFault:UESignal:CSETtings <*Enable*> Default Settings

ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15

If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.	all

CONFigure:UESignal:SCODe:SECondary *<Code>*				Scrambling Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HFFFFFF	Scrambling long code number	#H0	–	V3.15

Description of command	Sig. State
This command defines the number of the long code that is used to scramble the uplink WCDMA signal. The input of a scrambling code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.	all

CONFigure:UESignal:AMODe *<Mode>*				Analysis Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
WOOFfset | WIOFfset	Measurement without origin offset Measurement with origin offset	WIOF	–	V3.15

Description of command	Sig. State
This command defines whether a possible origin offset is included in the measurement results (WIOFfset) or subtracted out (WOOFfset).	SOFF SON REG

CONFigure:UESignal:DPCH:SYMode *<Mode>*				Sync. Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ASL | SYNC	All Slots sync. mode Synchronous mode	ASL	–	V3.15

Description of command	Sig. State
This command defines whether the slot number is to be deduced from the pilot bits in the captured signal *(ASL)* or assumed to be defined by the `CONFigure:UESignale:DPCH: SNUMber` command *(SYNC)*.	all

CONFigure:UESignal:DPCH:SNUMber *<Slot_No>*				Measurement Slot Number
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14	Measurement slot no. within the frame	0	–	V3.15

Description of command	Sig. State
This command defines the measured slot number of the captured signal within the 10 ms frame. The value is taken into account in the `CONFigure:UESignal:DPCH:SYMode SYNC` setting.	all

CONFigure:UESignal:DPCH:CMODe *<Mode>*				Correlation Mode
<Slot_No>	Description of parameters	Def. value	Def. unit	FW vers.
0 | 1	DPCCH DPCCH + DPDCH	0	–	V3.15

Description of command	Sig. State
This command defines which DPCH contributions are used for the correlation analysis.	all

CONFigure:UESignal:DPDCh:AUTO:THReshold <*THReshold*> Threshold

<Rate>	Description of parameters	Def. value	Def. unit	FW vers.
–25 dB to +10 dB	Power threshold for each DPDCH$_n$	–10	dB	V3.15

Description of command	Sig. State
This command defines the minimum signal strength of each DPDCH in the WCDMA signal to be detected in the automatic channelization code search. The setting is taken into account if one of the `CDPower:AUTomatic` applications is active or if the synchronization mode in the `MODulation:WCDMA...` application (command `CONF:MOD:WCDM:DPCH:CONT:CCM`) is set to `AUTomatic`.	all

DEFault:UESignal <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.	SOFF SON REG

Subsystem UESignal:PCONtrol (Power Control)

The subsystem *UESignal:PCONtrol* sets the parameters to control the transmitter output power of the UE and define its initial power at random access. The subsystem corresponds to the *UE Power Control* section in the *UE Signal* tab in the popup menu *Connection Control*.

DEFault:UESignal:PCONtrol <*Enable*> Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.	SOFF SON REG

CONFigure:UESignal:PCONtrol:UEPower <*Power*> Max. Allowed UE Power

<Power>	Description of parameters	Def. value	Def. unit	FW vers.
– 50 dBm to +33 dBm	Max. allowed UE power	+33.0	dBm	V3.15

Description of command	Sig. State
This command defines the maximum allowed output power of the UE transmitter.	all

CONFigure:UESignal:PCONtrol:TPOWer:VALue *<Power>*				UL Target Power
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
– 50 dBm to +33 dBm	UE target power	–20	dBm	V3.40
Description of command				Sig. State
This command defines the maximum allowed output power of the UE transmitter. The setting is relevant if the TPC pattern type is set to *Closed Loop* (`CONFigure:BSSignal:TPC:PTYPe<nr> CLOP`).				all

CONFigure:UESignal:PCONtrol:TPOWer:REFerence *<Type>*				UL Target Power Reference
<Power>	Description of parameters	Def. value	Def. unit	FW vers.
TPOWer | DPCCh	Total power DPCCH power	TPOWer	–	V3.40
Description of command				Sig. State
This command selects the UL signal contribution that is used as the *UL Target Power* (command `CONFigure:UESignal:PCONtrol:TPOWer:UPLink`).				all

CONFigure:UESignal:PCONtrol:OLPC:INTerference *<Level>*				UL Interference
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–110 dBm to –70 dBm	UL interference level	–80	dBm	V3.15
Description of command				Sig. State
This command defines the estimated UL interference level in dBm, contained in System Information Block type 7.				SOFF SON REG

CONFigure:UESignal:PCONtrol:OLPC:CVALue *<Level>*				Constant Value
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to –10 dB	Constant offset value	–29	dB	V3.15
Description of command				Sig. State
This command defines a constant offset for the initial preamble power.				SOFF SON REG

CONFigure:UESignal:PCONtrol:OLPC:PCPich:RPOWer *<Level>*				Reported P-CPICH Power
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–10 dBm to +50 dBm	Reported P-CPICH power	+31	dBm	V3.15
Description of command				Sig. State
This command defines the P-CPICH power reported to the UE.				SOFF SON REG

CONFigure:UESignal:PCONtrol:OLPC:DPCCh:POFFset *<Level>*				DPCCH Power Offset
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–164.0 dB to –6.0 dB	DPCCH power offset	–80.0	dB	V3.15
Description of command				Sig. State
This command defines the DPCCH power offset. The allowed step width is 2 dB.				SOFF SON REG

Subsystem BSSignal (WCDMA Signal)

The subsystem *BSSignal* configures the DL RF signal that the CMU generates to emulate a UTRAN cell. It corresponds to the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:CHANnel ***<Number>***				RF Channel Downlink
<Number>	Description of parameters	Def. value	Def. unit	FW vers.
2112.4 MHz to 2167.6 MHz (ch. no. 10562 to 10838) 1932.4 MHz to 1987.6 MHz (ch. no. 9662 to 9938) 1807.4 MHz to 1877.6 MHz (ch. no. 9037 to 9388)	Input frequency for Op. Band I (in multiples of 200 kHz) Input freq. for Op. Band II (in multiples of 200 kHz) Input freq. for Op. Band II (in multiples of 200 kHz)	2112.6 (ch. no. 10563) 1932.4 (ch. no. 9662) 1807.4 (ch. no. 9037)	MHz	V3.15
Description of command				Sig. State
This command defines the carrier frequency of the RF signal analyzed. With the command `[SENSe:]BSSignal:CHANnel:UNIT`, the default frequency unit can be changed, and UARFCN (UTRA Absolute Radio Frequency Channel Numbers) can be entered instead of frequencies. In the latter case, the assignment of channel numbers and frequencies follows 3GPP specifications. **Note:** *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:BSS:CHAN CH` and their channel numbers.*				all

UNIT:BSSignal:CHANnel ***<Unit>***				Frequency Unit
<Unit>	Description of parameters	Def. value	Def. unit	FW vers.
HZ | KHZ | MHZ | GHZ | CH	Frequency unit Channel number (UARFCN)	MHz	–	V3.15
Description of command				Sig. State
This command defines whether the frequency of the BS signal is specified in frequency units or as an UARFCN. **Note:** *Operating band II contains additional channels that are off the 200 kHz raster. These channels must be selected with `UNIT:BSS:CHAN CH` and their channel numbers.*				all

CONFigure:BSSignal:FOFFset ***<FrequencyOffset>***				Frequency Offset
<FrequencyOffset>>	Description of parameters	Def. value	Def. unit	FW vers.
–100.000 kHz to +100.000 kHz	Frequency offset	0	kHz	V3.15
Description of command				Sig. State
This command defines an offset for the RF generator frequency set with the command `CONFigure:BSSignal:CHANnel`. The offset frequency must be in multiples of 1 Hz.				all

CONFigure:BSSignal:SCODe:PRIMary ***<Code>***				Primary Scrambling Code
<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H000 to #H1FF	Primary scrambling code	#H9	–	V3.15
Description of command				Sig. State
This command defines the primary scrambling code for the downlink RF generator signal. The range of scrambling code numbers corresponds to 0 to 8192 decimal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				SOFF SON REG

CONFigure:BSSignal:LREFerence <*Reference*> Level Reference

<Reference>	Description of parameters	Def. value	Def. unit	FW vers.
PCPich | **OPOWer**	Relative to P-CPICH level Relative to Output Channel Power	PCPich	–	V3.15

Description of command	Sig. State
This command qualifies whether all channel power are expressed relative to the (absolute) P-CPICH level (`CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary`) or to the total Output Channel Power (`CONFigure:BSSignal:OPOWer`).	all

CONFigure:BSSignal:OPOWer <*Level*> Output Channel Power

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–147.1 dBm to –37.1 dBm	Output ch. power if RF 1 is used	–51.6	dBm	V3.15
–147.1 dBm to –20.1 dBm	Output ch. power if RF 2 is used	–51.6	dBm	
–100.1 dBm to +2.9 dBm	O. ch. power if RF 3 OUT is used	–51.6	dBm	

Description of command	Sig. State
This command sets the absolute output channel power of the BS signal. This level is the reference for all other physical and synchronization channel levels and can not be switched off.	all

CONFigure:BSSignal:OCNS <*Level*> OCNS

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **OFF**	Relative OCNS level OCNS switched off	OFF	dB	V3.15

Description of command	Sig. State
This command sets the level of the Orthogonal Channel Noise Simulator relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). The setting is ignored if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel All Physical Channel Levels
<P-CPICH_abs> \| <P-CPICH_rel>, <P-SCH>, <S-SCH>, <P-CCPCH>, <S-CCPCH>, <PICH>, <AICH> <DPDCH>, <Power Offset>

<P-CPICH_abs>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–55.0	dBm	V3.50
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–55.0	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–55.0	dBm	
<P-CPICH_rel>	Description of parameters	Def. value	Def. unit	FW vers.
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.50
<P-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	P-SCH level (level reference = P-CPICH)	–5.0	dB	V3.50
–30 dB to 0 dB	P-SCH level (level reference = total channel power)	–	dB	
<S-SCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB |	S-SCH level (level reference = P-CPICH)	–5.0	dB	V3.50
–30 dB to 0 dB	S-SCH level (level reference = total channel power)	–	dB	

<P-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	P-CCPCH level (level ref. = P-CPICH) P-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.50
<S-CCPCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	S-CCPCH level (level ref. = P-CPICH) S-CCPCH level (level reference = total channel power)	–2.0 –	dB dB	V3.50
<PICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	PICH level (level ref. = P-CPICH) PICH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<AICH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	AICH level (level ref. = P-CPICH) AICH level (level reference = total channel power)	–5.0 –	dB dB	V3.50
<DPDCH>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB | **–30 dB to 0 dB**	DPDCH level (level ref. = P-CPICH) DPDCH level (level reference = total channel power)	–7.0 –	dB dB	V3.50
<Power Offset>	Description of parameters	Def. value	Def. unit	Sig. State
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	all

Description of command

This command sets all physical channel level at once. The levels can be set relative to the P-CPICH level (in which case *<P-CPICH_abs>* is used) or relative to the total channel power (*<P-CPICH_rel>* is used), depending on the `CONFigure:BSSignal:LREFerence` setting.

Note: *The instrument checks the levels for consistence before activating the settings. This is important especially if the levels are defined relative to the total channel power and must not exceed this fixed value.*

If the PICH or AICH level is changed while the CMU is in the REG or CEST states, the cell is intermediately removed and the UE is forced to register and/or connect again. To avoid delays, it is recommended to configure the PICH or AICH levels in the SOFF or SON states. The other levels can be changed any time.

) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command `CONFigure:BSSignal:OPOWer`)*. If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.

DEFault:BSSignal*<Enable>* Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	All parameters are set to their default values All or some parameters differ from the default values	ON	–	V3.15

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	SOFF SON REG

Subsystem BSSignal:DCH (Dedicated Channel)

The subsystem *BSSignal:DCH* selects and configures the dedicated channel that the CMU used to set up and maintain a connection. It corresponds to the *Dedicated Channel (DCH)* section in the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:DCH:TYPE <*Type*> Dedicated Channel Type

<Type>	Description of parameters	Def. value	Def. unit	FW vers.
SRAB | RMC | VOIC	Signalling Radio Access Bearer Reference Measurement Channel Voice Channel	SRAB	–	V3.15

Description of command	Sig. State
This command selects the dedicated channel to be allocated between the CMU/UTRAN and the UE.	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:RTYPe <*Bit_Rate*> Reference Channel Type

<Bit_Rate>	Description of parameters	Def. value	Def. unit	FW vers.
RMC12 | RMC64 |	Symmetric UL/DL information bit rates	RMC12	(kbps)	V3.15
RMC144 | RMC64_144 |				V3.40
RMC384 | RMC64_384 |				V3.50
RMC144_384	Asymmetric UL/DL information bit rates			

Description of command	Sig. State
This command sets the information bit rate of the 3GPP DL Reference Measurement Channel. The setting takes effect if an RMC is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE RMC`).	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:DLRessource <*Resources*> DL Resources in Use

<Resources>	Description of parameters	Def. value	Def. unit	FW vers.
	Percentage of transp. blocks with data:			
P1000 |	100 % (all blocks filled)	P1000	–	V3.50
P0500 | P0250 | P0167 |P0125 |	1/2, 1/4, 1/6, 1/8 of all all blocks filled			
P0100 | P0083 | P0071 | P0063 |	1/10, 1/12, 1/14, 1/16 filled			
P0056 | P0050 | P0045 | P0042 |	1/18, 1/20, 1/22, 1/24 filled			
P0038 | P0036 | P0033 | P0031	1/26, 1/28, 1/30, 1/8 filled			

Description of command	Sig. State
This command defines the percentage of DL RMC transport blocks that are filled with information bits.	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:UCRC <*Enable*> Uplink CRC

<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	UE sends CRC, symmetric transport block size UE doesn't send CRC, asymmetric transport block size	OFF	–	V3.15

Description of command	Sig. State
This command enables or disables the uplink CRC. The BLER can be measured with disabled CRC only.	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:TMODe <*Mode*>		Test Mode		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	RMC connection without test mode	MODE2	–	V3.15
ON |	RMC connection with test mode			
MODE1 |	RMC connection with test loop mode 1			
MODE2	RMC connection with test loop mode 2			

Description of command	Sig. State
This command selects the operating mode that the UE enters after connecting to the UTRAN/CMU. The setting takes effect if an RMC is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE RMC`).	SOFF SON REG

CONFigure:BSSignal:DCH:RMC:SDTCh <*Sequence*>		Channel Data Source DTCH		
<Sequence>	Description of parameters	Def. value	Def. unit	FW vers.
ALL0 |	Bit sequence consisting of zeros	PR9	–	V3.15
ALL1 |	Bit sequence consisting of ones			
ALT |	010101... bit sequence			
PR9 | PR11 | PR13 | PR15	Pseudo-random bit sequences			

Description of command	Sig. State
This command selects a bit pattern to be transmitted as user information on the DTCH. The setting takes effect if an RMC is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE RMC`).	SOFF SON REG

CONFigure:BSSignal:DCH:VOICe:SOURce <*Mode*>		Voice Source		
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
OFF |	No data looped back	ECHO	–	V3.40
ECHO |	CMU loops back voice data after 50 ms			
COD |	Codec			
LCOD |	Codec Low			
ECAL |	Encoder Cal			
DCAL |	Decoder Cal			
CCAL	Codec Cal			

Description of command	Sig. State
This command selects the signal path for voice data. The setting takes effect if a voice channel is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE VOIC`).	SOFF SON REG

CONFigure:BSSignal:DCH:VOICe:ACSet <*ACS*> Active Codec Set

<*ACS*>	Description of parameters	Def. value	Def. unit	FW vers.
A |	ACS with single codec mode: 12.2 kbps data rate	A	–	V3.40
B |	ACS with single codec mode: 10.2 kbps data rate			
C |	ACS with single codec mode: 7.95 kbps data rate			
D |	ACS with single codec mode: 7.4 kbps data rate			
E |	ACS with single codec mode: 6.7 kbps data rate			
F |	ACS with single codec mode: 5.9 kbps data rate			
G |	ACS with single codec mode: 5.15 kbps data rate			
H |	ACS with single codec mode: 4.75 kbps data rate			
M	ACS with four codec modes: 12.2 kbps, 7.95 kbps, 5.9 kbps and 4.75 kbps			

Description of command	Sig. State
This command defines the Active Code Set containing the codec modes (data rates) that the CMU and the UE can use for transmission.	SOFF SON REG

CONFigure:BSSignal:DCH:SRAB:SRB <*Rate*> SRB

<*Rate*>	Description of parameters	Def. value	Def. unit	FW vers.
K2_5 |	2.5 kbps Signalling Radio Access Bearer	K3_4	–	V3.15
K3_4 |	3.4 kbps Signalling Radio Access Bearer			
K13_6	13.6 kbps Signalling Radio Access Bearer			

Description of command	Sig. State
This command selects the data rate of the SRB in kbps. The setting takes effect if a SRAB is selected as dedicated channel (`CONFigure:BSSignal:DCH:TYPE SRAB`).	SOFF SON REG

DEFault:BSSignal:DCHannel <*Enable*> Default Settings

<*Enable*>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	All parameters are set to their default values	ON	–	V3.40
OFF	All or some parameters differ from the default values			

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.	SOFF SON REG

Subsystem BSSignal:PHYSical (Downlink Physical Channels)

The subsystem *BSSignal:PHYSical* defines the level of the individual physical channels contributing to the BS signal. It corresponds to the *Downlink Physical Channels* section in the *BS Signal* tab of the popup menu *Connection Control*.

Note: *The command* `CONFigure:BSSignal:LREFerence` *sets all physical channel levels at once. Using this command is preferable because it allows the instrument to check the consistence of the entire level set and avoid conflicting settings during the program sequence.*

CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary *<Level_abs>* | *<Level_rel>* P-CPICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–147.0 dBm to –37.0 dBm*	Absolute P-CPICH level if RF 1 is used	–55.0	dBm	V3.15
–147.0 dBm to –20.0 dBm*	Absolute P-CPICH level if RF 2 is used	–55.0	dBm	
–100.0 dBm to +3.0 dBm*	Abs. P-CPICH level if RF 3 OUT is used	–55.0	dBm	
<Level_rel>	**Description of parameters**	**Def. value**	**Def. unit**	**FW vers.**
–30 dB to 0 dB	Relative P-CPICH level	–	dB	V3.15

Description of command	Sig. State
This command sets the level of the Primary Common Pilot Channel in absolute units or relative to the total channel power, depending on the *`CONFigure:BSSignal:LREFerence`* setting. The absolute level is the reference for all other physical and synchronization channel levels and can not be switched off. *) The reported level ranges correspond to the total output power ranges at the three RF output connectors (see command *`CONFigure:BSSignal:OPOWer`*). If other channel contributions are switched on, the P-CPICH level must be reduced so that the total output power range is not exceeded.	all

CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary *<Level>* P-SCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	P-SCH level P-SCH channel switched off	–5.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Primary Synchronization Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary *<Level>* S-SCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	S-SCH level S-SCH channel switched off	–5.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Secondary Synchronization Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary *<Level>* P-CCPCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	P-CCPCH level P-CCPCH channel switched off	–2.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Primary Common Control Physical Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary <*Level*> P-CCPCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	S-CCPCH level S-CCPCH channel switched off	–2.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Secondary Common Control Physical Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:LEVel:PICH <*Level*> PICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	PICH level P-SCH channel switched off	–5.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Page Indicator Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	SON SOFF Q: all

CONFigure:BSSignal:PHYSical:LEVel:AICH <*Level*> AICH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB*	AICH level AICH channel switched off	–5.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Acquisition Indicator Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	SON SOFF Q: all

CONFigure:BSSignal:PHYSical:LEVel:DPDCh <*Level*> DPDCH Level

<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–35 dB to +15 dB* | OFF	DPDCH level DPDCH channel switched off	–7.0	dB	V3.15

Description of command	Sig. State
This command sets the level of the Dedicated Physical Data Channel relative to the P-CPICH level (see command *CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary*). *) The relative level must not exceed 0 dB if the channel powers are expressed relative to the total output channel power (`CONFigure:BSSignal:LREFerence OPOWer`).	all

CONFigure:BSSignal:PHYSical:CODE:DPDCh *<Code>*				DPDCH Channelization Code
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
2 to 127	DPDCH Channelization Code	6	–	V3.15
Description of command				Sig. State
This command assigns a channelization code to the Dedicated Physical Data Channel.				SOFF SON REG

CONFigure:BSSignal:PHYSical:DPCH:POFFset *<Level>*				Power Offset
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
0.0 dB to 6.0 dB	DPCCH/DPDCH power offset	0.0	dB	V3.15
Description of command				Sig. State
This command sets the ratio of DPCCH to DPDCH power.				all

CONFigure:BSSignal:SCODe:SECondary *<Code>*				Secondary Scrambling Code
<Code>>	Description of parameters	Def. value	Def. unit	FW vers.
#H0 to #HF	Secondary scrambling code	#H0	–	V3.15
Description of command				Sig. State
This command defines the secondary scrambling code for the downlink RF generator signal. The input of a scrambing code may be in decimal or in hexadecimal format, the latter preceded by #H (as specified in IEEE 488.2). The output is always in hexadecimal format, preceded by #H.				SOFF SON REG

DEFault:BSSignal:PHYSical *<Enable>*				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	All parameters are set to their default values All or some parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				SOFF SON REG

Subsystem BSSignal:TPC (Transmit Power Control)

The subsystem *BSSignal:TPC* defines the Transmit Power Control information transmitted on the DPCH. It corresponds to the *TPC Settings* section in the *BS Signal* tab of the popup menu *Connection Control*.

CONFigure:BSSignal:TPC:MODE <*Algorithm*>				TPC Algorithm
<Algorithm>	Description of parameters	Def. value	Def. unit	FW vers.
ALG1 | ALG2	TPC algorithm 1 or 2	ALG2	–	V3.15

Description of command	Sig. State
This command defines the power control algorithm used to control the UE transmit power.	SOFF SON REG Q:all

CONFigure:BSSignal:TPC:SSIZE <*Step*>				TPC Step Size
<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 dB | 2 dB	TPC step size 1 dB or 2 dB	1	dB	V3.15

Description of command	Sig. State
This command defines the relative power difference of the UE between two consecutive slots if it is commanded to change its output power. **Note:** *This command is available if TPC algorithm 1 is used. According to the standard, 1 dB must be set for TPC algorithm 2 (see command `CONFigure:BSSignal:TPC:MODE`).*	SOFF SON REG Q:all

CONFigure:BSSignal:TPC:PSET <*Setup*>				TPC Pattern Setup
<Setup>	Description of parameters	Def. value	Def. unit	FW vers.
SET1 | **SET2 |** **SET3 |** **SET4 |** **SET5**	Setup 1 Setup 1 Setup 1 Setup 1 Setup 1	SET1	–	V3.40

Description of command	Sig. State
This command the TPC pattern setup to be used. All setups no. 1 to 5 are defined by the *TPC Pattern Type* (`CONFigure:BSSignal:TPC:PTYPe<nr>`) and the single *Pattern* (`CONFigure:BSSignal:TPC:PATTern<nr>`).	all

CONFigure:BSSignal:TPC:PTYPe<nr> *<Profile>* Pattern Type

<Profile>	Description of parameters	Def. value	Def. unit	FW vers.
ALT |	Alternating 0,1	seed below	–	V3.15, V3.40 (suffix)
ALL0 |	Bit sequence consisting of zeros			
ALL1 |	Bit sequence consisting of ones			
CPAT |	Continuous pattern			
SPA0 |	Single pattern + All 0			
SPA1 |	Single pattern + All 1			
SPAL |	Single pattern + Alternating			
CLOP	Closed Loop			V3.40

Description of command	Sig. State
This command defines the bit pattern transmitted on the Dedicated Traffic Channel. The single pattern is defined via `CONFigure:BSSignal:TPC:PATTern`; see below. The numeric suffix <nr> = 1 to 5 discriminates between the five different test setups; see `CONFigure:BSSignal:TPC:PSET`. The default pattern type depends on the test setup:	all

<nr>	1	2	3	4	5
Pattern Type	CLOP	SPAL	SPAL	CPAT	CPAT

CONFigure:BSSignal:TPC:PATTern<nr> *<Pattern>* Pattern

<Pattern>	Description of parameters	Def. value	Def. unit	FW vers.
"<3 bit to 22 bit sequence>"	Single TPC pattern	<nr> = 1: not used <nr> = 1: “1111111111” <nr> = 1: “0000000000” <nr> = 1: “11111111110000000000” <nr> = 1: “10000010011111011010”	–	V3.15, V3.40 (suffix)

Description of command	Sig. State
This command defines the single bit pattern that is used to construct the TPC profile; see command `CONFigure:BSSignal:TPC:PTYPe` above. The numeric suffix <nr> = 1 to 5 discriminates between the five different test setups; see `CONFigure:BSSignal:TPC:PSET`.	all

CONFigure:BSSignal:TPC:RPATtern ON Repeat Pattern

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Send single TPC pattern	–OFF	–	V3.15

Description of command	Sig. State
This command has no query form. It causes a single TPC pattern (defined via `CONFigure:BSSignal:TPC:PATTern`) to be sent at the next allowed frame boundary; see description in Chapter 4. The command is executed only if one of the pattern types `SPA0`, `SPA1` or `SPAL` is selected (command `CONFigure:BSSignal:TPC:PTYPe`); otherwise the CMU generates the SCPI error no. –200, “Execution Error”.	all

DEFault:BSSignal:TPC Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON |	The parameters are set to default values	ON	–	V3.15
OFF	Some or all parameters differ from the default values			

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.	all

Subsystem NETWork (Network Parameters)

The subsystem *NETWork* configures parameters that the CMU reports to the UE. It corresponds to the *Network* tab of the popup menu *Connection Control*.

CONFigure:NETWork:OBANd <*Band*>				Operating Band
<Band>	Description of parameters	Def. value	Def. unit	FW vers.
OB1 | OB2 | OB3	Operating Band I Operating Band II Operating Band III	OPB1	–	V3.15
Description of command				Sig. State
This command selects the Operating Band of the UE. The channels and band frequencies of all operating bands are listed in Chapter 4.				SOFF, SON, REG Q: all

Subsystem NETWork:IDENtity

The subsystem *NETWork:IDENtity* sets parameters of the mobile radio network that the CMU transfers to the UE under test. The subsystem corresponds to the *Network Identity* section in the *Network* tab of the *Connection Control* menu.

CONFigure:NETWork:IDENtity:MCC <*Code*>				MCC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 999	Mobile Country Code	001	–	V3.15
Description of command				Sig. State
This command defines the 3-digit Mobile Country Code.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:MNC <*Code*>				MNC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 99 | **0 to 999**	2-digit Mobile Network Code 3-digit Mobile Network Code	01	–	V3.15 V3.50
Description of command				Sig. State
This command defines the 2 or 3-digit Mobile Network Code, see `CONFigure:NETWork:IDENtity:MNC:DIGits`.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:MNC:DIGits <*Code*>				MNC: No. of Digits
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
TWO | THR	2 or 3-digit Mobile Network Code	01	–	V3.50
Description of command				Sig. State
This command defines the number of digits of the Mobile Network Code, see `CONFigure:NETWork:IDENtity:MNC`. If `TWO` is set while a three-digit MNC is active, then the MNC is reset to the default value 01.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:LAC ***<Code>***				LAC
<Code>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 65533 and 65535	Location Area Code	1	–	V3.15
Description of command				Sig. State
This command defines the Location Area Code.				SOFF, SON Q: all

CONFigure:NETWork:IDENtity:URA ***<Interval>***				URA Identity
<Interval>	Description of parameters	Def. value	Def. unit	FW vers.
<16-digit binary>	UTRAN Registration Area Identity	0000 0000 0000 0001	–	V3.15
Description of command				Sig. State
This command sets the 16-digit URA identity transmitted to the UE for random access.				SOFF SON REG

DEFault:NETWork:IDENtity				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | **OFF**	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

Subsystem NETWork:RAC... (Random Access Settings)

The subsystem *NETWork:RAC...* sets the parameters required for initiating a physical random access procedure of the UE. It corresponds to the *Random Access Settings* section in the *Network* tab of the popup menu *Connection Control*.

CONFigure:NETWork:RAC:TTI ***<Interval>***				RACH TTI
<Interval>	Description of parameters	Def. value	Def. unit	FW vers.
T10 | T20	10 ms or 20 ms TTI	T10	–	V3.15
Description of command				Sig. State
This command selects one of the two RACH Transmission Time Intervals allowed in FDD systems.				SOFF, SON REG

CONFigure:NETWork:RAC:PREamble:MCYCles ***<Cycles>***				Max. Preamble Cycles
<Cycles>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 32	Maximum number of preamble cycles	2	–	V3.15
Description of command				Sig. State
This command defines the maximum number of times the preamble cycle is repeated.				SOFF, SON REG

CONFigure:NETWork:RAC:PREamble:SSIZe <*Step*> Step Size

<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 dB to 8 dB	Step size	3	dB	V3.15

Description of command	Sig. State
This command defines the transmit power difference between two consecutive preambles.	SOFF SON REG

CONFigure:NETWork:RAC:PREamble:TAICh <*Step*> AICH Transmission Timing

<Step>	Description of parameters	Def. value	Def. unit	FW vers.
3 | 4	AICH transmission timing	3	(slots)	V3.15

Description of command	Sig. State
This command defines the minimum time delay between two consecutive preambles.	SOFF SON REG

CONFigure:NETWork:RAC:PREamble:MRETrans <*Step*> Max. Retransmission

<Step>	Description of parameters	Def. value	Def. unit	FW vers.
1 to 64	Max. no. of retransmissions	6	–	V3.15

Description of command	Sig. State
This command defines the max. number of preambles to be transmitted before a single preamble cycle is terminated.	SOFF SON REG

CONFigure:NETWork:RAC:PREamble:RAC:POFFset <*Step*> RACH Msg. Part Power Offset

<Step>	Description of parameters	Def. value	Def. unit	FW vers.
–5 dB to +10 dB	RACH message part power offset	–5	dB	V3.15

Description of command	Sig. State
This command defines the power difference between the last preamble transmitted and the RACH message part.	SOFF SON REG

CONFigure:NETWork:RAC:DRXCycle <*Length*> DRX Cycle Length

<Length>	Description of parameters	Def. value	Def. unit	FW vers.
6 to 9	Cycle Length, 2^6 to 2^9 frames (128 ms to 512 ms)	8	2^n frames	V3.15

Description of command	Sig. State
This command defines the length of a Discontinuous Reception (DRX) cycle where the UE needs only to monitor one Page Indicator in one Paging Occasion.	SOFF, SON Q: all

Subsystem NETWork:REQuest (Requested UE Data)

The subsystem *NETWork:REQuest* defines which UE data are requested and transferred to the CMU during registration and how registration is performed. It corresponds to the *Requested UE Data* section in the *Network* tab of the popup menu *Connection Control*. Disabling the check of UE data accelerates the registration process.

Note: *All* NETWork:REQuest... *settings can still be changed in the* REG *signalling state. They remain valid for the next registration(s).*

CONFigure:NETWork:REQuest:ACAPability ***<Enable>*** UE Radio Access Capability

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable request of radio access capability Disable request of radio access capability	ON	–	V3.15

Description of command	Sig. State
This command qualifies whether or not the CMU requests the UE's radio access capability.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:IMEI ***<Enable>*** IMEI

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable request of IMEI Disable request of IMEI	OFF	–	V3.15

Description of command	Sig. State
This command qualifies whether or not the CMU requests the UE's International Mobile station Equipment Identity.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:AUTHenticat ***<Enable>*** Authentication

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable authentication during registration Disable authentication during registration	ON	–	V3.40

Description of command	Sig. State
This command switches the authentication procedure during registration on or off. If authentication is enabled, the *Security* mode can be activated in addition; see `CONFigure:NETWork:REQuest:SECurity`.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:SECurity ***<Enable>*** Security

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Enable security mode Disable security mode	ON	–	V3.40

Description of command	Sig. State
This command switches the security mode during authentication on or off. Security is always disabled if authentication is switched off; see `CONFigure:NETWork:REQuest:AUTHenticat`.	SOFF, SON, REG Q: all

CONFigure:NETWork:REQuest:RRCC ***<Enable>*** Keep RRC Connection

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Keep RRC connection after registration Release RRC connection after registration	OFF	–	V3.50

Description of command	Sig. State
This command qualifies whether or not an RRC connection set up during registration is released after the registration is terminated.	SOFF, SON Q: all

CONFigure:NETWork:REQuest:HACTime ***<Frames>*** Handover Activation Time

Parameter	Description of parameters	Def. value	Def. unit	FW vers.
5 to 50	HO activation time, integer no. of frames	OFF	(frames)	V3.50

Description of command	Sig. State
This command defines the delay time (number of WCDMA frames with a duration of 10 ms) before the UE, after receiving a HANDOVER COMMAND from the CMU, initiates the WCDMD to GSM handover.	SOFF, SON Q: all

DEFault:NETWork:REQuest Default Settings

<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.40

Description of command	Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.	SOFF, SON, REG Q: all

Subsystem IOConnector (Connectors)

The subsystem for input and output configures the input and output connectors. The subsystem corresponds to the tab *RF* ⊙ in the popup menu *Connect. Control*.

INPut[:STATe] ***<State>*** RF Input

<State>	Description of parameters	Def. value	Def. unit	FW vers.
RF1 RF2 RF4	Connector RF1 used as input Connector RF2 used as input Connector RF4 IN used as input	RF2	–	V3.15

Description of command	Sig. State
This command determines the connector to be used for RF input signals. The bidirectional connectors RF1 and RF2 can be used both as input and output connectors in the same measurement (see `OUTPut[:STATe]`). Only one input and one output may be active at the same time, a new RF input setting overwrites the previous one.	all

OUTPut[:STATe] *<State>* RF Output

<State>	Description of parameters	Def. value	Def. unit	FW vers.
RF1	Connector RF1 used as output	RF2	–	V3.15
RF2	Connector RF2 used as output			
RF3	Connector RF3 OUT used as output			

Description of command	Sig. State
This command determines the connector to be used for RF output signals. The bidirectional connectors RF1 and RF2 can be used as input and output connectors in the same measurement (see `INPut[:STATe]`). Only one input and one output may be active at the same time, a new RF output setting overwrites the previous one.	all

[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation >* Ext. Att. Input
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude] *<Attenuation >*

<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1,2,4	0	dB	V3.15

Description of command	Sig. State
This command assigns an external attenuation value to one of the inputs defined before (see command `INPut:STATe`).	all

[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>* Ext. Att. Output
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude] *<Attenuation>*

<Attenuation>	Description of parameters	Def. value	Def. unit	FW vers.
–50 dB to +50 dB	Ext. attenuation at RF <nr>, where <nr> = 1,2,3	0	dB	V3.15

Description of command	Sig. State
This command assigns an external attenuation value to one of the outputs defined before (see command `OUTPut:STATe`).	all

ROUTe:SPENcoder[:INPut] *<Source>* Speech Encoder

<Source>	Description of parameters	Def. value	Def. unit	FW vers.
HANDset |	Handset is used as source	HAND	–	V3.50
GENerator	AF generator is used as source			

Description of command	Sig. State
This command determines the input source that feeds the CMU speech encoder (option CMU-B52).	all

ROUTe:SPDecoder[:OUTPut] *<Destination>* Speech Decoder

<Destination>	Description of parameters	Def. value	Def. unit	FW vers.
HANDset |	Speech decoder output routed to the handset	HAND	–	V3.50
ANALyzer |	Speech dec. output routed to primary AF analyzer			
ANA2 |	Speech dec. output routed to secondary AF analyzer			
ABOTh	Speech dec. output routed to both AF analyzers			

Description of command	Sig. State
This command routes the CMU speech decoder output (option CMU-B52).	all

Subsystem DM:CLOCk (Synchronization)

The subsystem *DM:CLOCk* sets a system clock specific to the network. This frequency is set in the tab *Synch.* in the popup menu *Connect. Control*.

SOURce:DM:CLOCk:STATe *<Mode>*				REF OUT 2 on/off
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Switching the system clock frequency on/off	OFF	–	V3.15
Description of command				Sig. State
This command switches the system clock frequency at output *REF OUT 2* on or off.				all

SOURce:DM:CLOCk:FREQuency *<Frequency>*				REF OUT 2
<Frequency>	Description of parameters	Def. value	Def. unit	FW vers.
0.960 MHz to 30.720 MHz	System clock frequency	30.720	MHz	V3.15
Description of command				Sig. State
This command determines the system clock frequency applied to *REF OUT 2*. The frequency entered is internally rounded to one of the following discrete values: 0.960 0.991 1.396 1.463 2.560 2.793 15.360 30.720				all

Subsystem TRIGger (Trigger Mode)

The subsystem *TRIGger* defines the trigger mode. It corresponds to the *Trigger* tab of the *Connection Control* menu.

TRIGger[:SEQuence]:SOURce *<Source>*				Source
<Source>	Description of parameters	Def. value	Def. unit	FW vers.
FRUN | EXTern | SIGN | IFPower	Trigger by measured timing of the analyzed input signal External trigger signal via AUX3 Trigger signal provided by internal signalling unit Narrow-band IF power trigger	SIGN	–	V3.15
Description of command				Sig. State
This command selects the trigger signal for the measurements.				all

TRIGger[:SEQuence]:DELay *<Slot_Delay>, <Delay_Offset>*				Slot Delay, Delay Offset
<Slots>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 14, –2559.75 to +2559.75	No. of slots between trigger time and measurement No of chips between trigger time and measurement (in multiples of ¼ chip periods)	0 0	(slots) (chips)	V3.15
Description of command				Sig. State
This command defines a delay time (integer number of slots plus additional delay offset) between the trigger time and the start of the measurement. The settings are ignored for free-run measurements (see command *TRIGger[:SEQuence]:SOURce*).				all

TRIGger[:SEQuence]:THReshold:IFPower *<Threshold>*				Level – IF Power
<Threshold>	Parameter description	Def. value	Default unit	FW vers.
–47 dB to 0 dB	IF power threshold	–26	dB	V3.50
Description of command				Sig. State
This command sets the IF signal level at which the measurement is triggered. The IF power threshold is defined relative to the maximum RF input level; see `[SENSe:]LEVel:MAXimum`. The setting has effect for trigger source `IFPower` only (see `TRIG:SEQ:SOUR`).				all

TRIGger[:SEQuence]:SLOPe *<Slope>*				Slope
<Slope>	Parameter description	Def. value	Default unit	FW vers.
POSitive | **NEGative**	Rising edge Falling edge	POS	–	V3.50
Description of command				Sig. State
This command qualifies whether the trigger event occurs on the *Rising Edge* or on the *Falling Edge* of the trigger signal. The setting has no influence on *Free Run* measurements (see `TRIG:SEQ:SOUR`).				all

DEFault:TRIGger[:SEQuence]				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	The parameters are set to default values Some or all parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to default values (the setting OFF results in an error message). If used as a query the command returns whether all parameters are set to default values *(ON)* or not *(OFF)*.				all

Subsystem LEVel (Input Level)

The subsystem *LEVel* controls the level in the RF input signal path. It corresponds to the table section *Analyzer Level* in the *UE Signal* tab of the *Connection Control* menu.

[SENSe:]LEVel:MODE <*Mode*>				Input Level – Mode
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
MANual | AUTomatic	Manual setting of max. input level Automatic setting corresponding to average power of signal applied	AUTomatic	–	V3.15
Description of command				Sig. State
This command defines the mode for setting the maximum input level.				all

[SENSe:]LEVel:MAXimum <*Level*>				Max. Level
<Level>	Description of parameters	Def. value	Def. unit	FW vers.
–0 dBm to +53 dBm	Maximum input level for RF1	+30.0	dBm	V3.15
+14 dBm to +39 dBm	Maximum input level for RF2	+30.0	dBm	
–37 dBm to 0 dBm	Maximum input level for RF 4 IN	0.0	dBm	
Description of command				Sig. State
This command defines the maximum input level. The value range depends on the RF input used and the external attenuation set (see command `[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]`).				all

[SENSe:]LEVel:ATTenuation <*Mode*>				Attenuation
<Mode>	Description of parameters	Def. value	Def. unit	FW vers.
NORMal |	Mixer level in normal range	LNOise	–	V3.15
LNOise |	Low noise (mixer level 10 dB higher than in normal setting)			
LDIStortion	Low distortion (mixer level 10 dB lower than in normal setting)			
Description of command				Sig. State
This command tunes the RF analyzer for normal setting, low noise level (full dynamic range), or low distortion (high intermodulation spacing).				all

DEFault:LEVel <*Enable*>				Default Settings
<Enable>	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	All parameters are set to their default values All or some parameters differ from the default values	ON	–	V3.15
Description of command				Sig. State
If used as a setting command with the parameter *ON* this command sets all parameters of the subsystem to their default values (the setting *OFF* causes an error message). If used as a query the command returns whether all parameters are set to their default values *(ON)* or not *(OFF)*.				all

Subsystem MMONitor (Message Monitor)

The subsystem *MMONitor* defines the address information necessary for connecting the *WCDMA Message Analyzer* installed on a PC to the CMU. It corresponds to the *Message Monitor* section in the *Misc.* tab of the *Connection Control* menu.

CONFigure:MMONitor:LOGging ***<Enable>***				Logging
Enable	Description of parameters	Def. value	Def. unit	FW vers.
ON | OFF	Logging enabled Logging disabled	OFF	–	V3.40
Description of command				Sig. State
This command enables *(On)* or disables message logging.				SOFF, SON

CONFigure:MMONitor:IPADdress ***<IP Address 1>, <IP Address 2>, <IP Address 3>, <IP Address 4>***				IP Address
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	0	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Forth segment of IP address	2	–	V3.40
Description of command				Sig. State
This command sets the IP address of the CMU.				SOFF, SON

CONFigure:MMONitor:SMASk ***<Subnet Mask 1>, <Subnet Mask 2>, <Subnet Mask 3>, <Subnet Mask 4>***				Subnet Mask
<Subnet Mask 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of Subnet Mask	255	–	
<Subnet Mask 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of Subnet Mask	255	–	
<Subnet Mask 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of Subnet Mask	255	–	
<Subnet Mask 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Forth segment of Subnet Mask	0	–	V3.40
Description of command				Sig. State
This command sets the Subnet Mask of the CMU.				SOFF, SON

CONFigure:MMONitor:HOST ***<IP Address 1>, <IP Address 2>, <IP Address 3>, <IP Address 4>***				Host Address
<IP Address 1>	Description of parameters	Def. value	Def. unit	
0 to 255,	First segment of IP address	192	–	
<IP Address 2>	Description of parameters	Def. value	Def. unit	
0 to 255,	Second segment of IP address	168	–	
<IP Address 3>	Description of parameters	Def. value	Def. unit	
0 to 255,	Third segment of IP address	0	–	
<IP Address 4>	Description of parameters	Def. value	Def. unit	FW vers.
0 to 255	Forth segment of IP address	2	–	V3.40
Description of command				Sig. State
This command sets the IP address of the host PC.				SOFF, SON

List of Commands

In the following, all remote-control commands of the WCDMA UE function groups are listed in alphabetical order. with their parameters and page numbers. They are arranged alphabetically according to the **second** keyword of the command so that related commands belong to the same group. The commands for the two test modes *Non Signalling* and *Signalling* are listed separately.

Table 6-1 Remote-control commands: Measurements (available in Non Sign. and Signalling)

Command (Measurements, Non Sig. and Signalling)	**Parameter**	**Remark**	**Page**
Code Domain Power – Automatic			
INITiate:CDPower:AUTomatic	–	no query	6.99
ABORt:CDPower:AUTomatic	–	no query	6.99
STOP:CDPower:AUTomatic	–	no query	6.99
CONTinue:CDPower:AUTomatic	–	no query	6.99
DEFault:CDPower:AUTomatic:CONTrol	ON | OFF	with query	6.101
CONFigure:CDPower:AUTomatic:CONTrol:DSFactor	AUTomatic | 4 | 8 | 16 | 32 | 64 | 128 | 256	with query	6.101
CONFigure:CDPower:AUTomatic:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.101
CONFigure:CDPower:AUTomatic:CONTrol:RMODe	SCALar | ARRay	with query	6.100
CONFigure:CDPower:AUTomatic:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.100
READ:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.102
FETCh:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.102
SAMPle:ARRay:CDPower:AUTomatic:ISIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.102
READ:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.102
FETCh:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.102
SAMPle:ARRay:CDPower:AUTomatic:QSIGnal:CURRent?	–100.0 dB to 0.0 dB	query only	6.102
FETCh:CDPower:AUTomatic:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.100
READ[:SCALar]:CDPower:AUTomatic?	<Result>	query only	6.102
FETCh[:SCALar]:CDPower:AUTomatic?	<Result>	query only	6.102
SAMPle[:SCALar]:CDPower:AUTomatic?	<Result>	query only	6.102
Code Domain Power – Manual			
INITiate:CDPower:MANual	–	no query	6.103
ABORt:CDPower:MANual	–	no query	6.103
STOP:CDPower:MANual	–	no query	6.103
CONTinue:CDPower:MANual	–	no query	6.103
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>	<CDP_Limit>	with query	6.107
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>	<CDP_Limit>	with query	6.107
CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:MANual:AVERage?	–100.0 dB to 0.0 dB	query only	6.108
FETCh:ARRay:CDPower:MANual:AVERage?	–100.0 dB to 0.0 dB	query only	6.108
SAMPle:ARRay:CDPower:MANual:AVERage?	–100.0 dB to 0.0 dB	query only	6.108
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>	<CDP_Limit>	with query	6.106

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:UPPer :CHANnel<nr>	<CDP_Limit>	with query	6.106
DEFault:CDPower:MANual:CONTrol	ON | OFF	with query	6.105
CONFigure:CDPower:MANual:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.105
CONFigure:CDPower:MANual:CONTrol:RMODe	SCALar | ARRay	with query	6.104
CONFigure:CDPower:MANual:CONTrol:STATistics	1 to 1000 | NONE	with query	6.104
CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:MANual:CURRent?	–100.0 dB to 0.0 dB	query only	6.108
FETCh:ARRay:CDPower:MANual:CURRent?	–100.0 dB to 0.0 dB	query only	6.108
SAMPle:ARRay:CDPower:MANual:CURRent?	–100.0 dB to 0.0 dB	query only	6.108
CONFigure:CDPower:MANual:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.103
DEFault:CDPower:MANual:LIMit	ON | OFF	with query	6.107
CALCulate:ARRay:CDPower:MANual:MAXimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:MANual:MAXimum?	–100.0 dB to 0.0 dB	query only	6.108
FETCh:ARRay:CDPower:MANual:MAXimum?	–100.0 dB to 0.0 dB	query only	6.108
SAMPle:ARRay:CDPower:MANual:MAXimum?	–100.0 dB to 0.0 dB	query only	6.108
CALCulate:ARRay:CDPower:MANual:MINimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:MANual:MINimum?	–100.0 dB to 0.0 dB	query only	6.108
FETCh:ARRay:CDPower:MANual:MINimum?	–100.0 dB to 0.0 dB	query only	6.108
SAMPle:ARRay:CDPower:MANual:MINimum?	–100.0 dB to 0.0 dB	query only	6.108
FETCh:CDPower:MANual:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.104
READ[:SCALar]:CDPower:MANual?	<Result>	query only	6.108
FETCh[:SCALar]:CDPower:MANual?	<Result>	query only	6.108
SAMPle[:SCALar]:CDPower:MANual?	<Result>	query only	6.108
Code Domain Rho – Automatic			
INITiate:CDPower:RAUTomatic	–	no query	6.99
ABORt:CDPower:RAUTomatic	–	no query	6.99
STOP:CDPower:RAUTomatic	–	no query	6.99
CONTinue:CDPower:RAUTomatic	–	no query	6.99
DEFault:CDPower:RAUTomatic:CONTrol	ON | OFF	with query	6.101
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor	AUTomatic | 4 | 8 | 16 | 32 | 64 | 128 | 256	with query	6.101
CONFigure:CDPower:RAUTomatic:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.101
CONFigure:CDPower:RAUTomatic:CONTrol:RMODe	SCALar | ARRay	with query	6.100
CONFigure:CDPower:RAUTomatic:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.100
READ:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?	0.0000 to 1.0000	query only	6.102
FETCh:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?	0.0000 to 1.0000	query only	6.102
SAMPle:ARRay:CDPower:RAUTomatic:ISIGnal:CURRent?	0.0000 to 1.0000	query only	6.102
READ:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?	0.0000 to 1.0000	query only	6.102
FETCh:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?	0.0000 to 1.0000	query only	6.102
SAMPle:ARRay:CDPower:RAUTomatic:QSIGnal:CURRent?	0.0000 to 1.0000	query only	6.102

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
FETCh:CDPower:RAUTomatic:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.100
READ[:SCALar]:CDPower:RAUTomatic?	<Result>	query only	6.102
FETCh[:SCALar]:CDPower:RAUTomatic?	<Result>	query only	6.102
SAMPle[:SCALar]:CDPower:RAUTomatic?	<Result>	query only	6.102
Code Domain Rho – Manual			
INITiate:CDPower:RMANual	–	no query	6.103
ABORt:CDPower:RMANual	–	no query	6.103
STOP:CDPower:RMANual	–	no query	6.103
CONTinue:CDPower:RMANual	–	no query	6.103
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:LOWer :CHANnel<nr>	<CD-ρ_Limit>	with query	6.107
CONFigure:CDPower:RMANual:AVERage:LIMit:POINt:ASYMmetric:UPPer :CHANnel<nr>	<CD-ρ_Limit>	with query	6.107
CALCulate:ARRay:CDPower:RMANual:AVERage:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:RMANual:AVERage?	0.0000 to 1.0000	query only	6.108
FETCh:ARRay:CDPower:RMANual:AVERage?	0.0000 to 1.0000	query only	6.108
SAMPle:ARRay:CDPower:RMANual:AVERage?	0.0000 to 1.0000	query only	6.108
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:LOWer :CHANnel<nr>	<CD-ρ_Limit>	with query	6.106
CONFigure:CDPower:RMANual:CMMax:LIMit:POINt:ASYMmetric:UPPer :CHANnel<nr>	<CD-ρ_Limit>	with query	6.106
DEFault:CDPower:RMANual:CONTrol	ON | OFF	with query	6.105
CONFigure:CDPower:RMANual:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.105
CONFigure:CDPower:RMANual:CONTrol:RMODe	SCALar | ARRay	with query	6.104
CONFigure:CDPower:RMANual:CONTrol:STATistics	1 to 1000 | NONE	with query	6.104
CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:RMANual:CURRent?	0.0000 to 1.0000	query only	6.108
FETCh:ARRay:CDPower:RMANual:CURRent?	0.0000 to 1.0000	query only	6.108
SAMPle:ARRay:CDPower:RMANual:CURRent?	0.0000 to 1.0000	query only	6.108
CONFigure:CDPower:RMANual:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.103
DEFault:CDPower:RMANual:LIMit	ON | OFF	with query	6.107
CALCulate:ARRay:CDPower:RMANual:MAXimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:RMANual:MAXimum?	0.0000 to 1.0000	query only	6.108
FETCh:ARRay:CDPower:RMANual:MAXimum?	0.0000 to 1.0000	query only	6.108
SAMPle:ARRay:CDPower:RMANual:MAXimum?	0.0000 to 1.0000	query only	6.108
CALCulate:ARRay:CDPower:RMANual:MINimum:MATChing:LIMit?	NMAU| NMAL | INV | OK	query only	6.109
READ:ARRay:CDPower:RMANual:MINimum?	0.0000 to 1.0000	query only	6.108
FETCh:ARRay:CDPower:RMANual:MINimum?	0.0000 to 1.0000	query only	6.108
SAMPle:ARRay:CDPower:RMANual:MINimum?	0.0000 to 1.0000	query only	6.108
FETCh:CDPower:RMANual:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.104
READ[:SCALar]:CDPower:RMANual?	<Result>	query only	6.108

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
FETCh[:SCALar]:CDPower:RMANual?	<Result>	query only	6.108
SAMPle[:SCALar]:CDPower:RMANual?	<Result>	query only	6.108
Modulation Measurements - EVM			
INITiate:MODulation:EVMagnitude:QPSK	–	no query	6.56
ABORt:MODulation:EVMagnitude:QPSK		no query	6.56
STOP:MODulation:EVMagnitude:QPSK		no query	6.56
CONTinue:MODulation:EVMagnitude:QPSK		no query	6.56
CONFigure:SUBarrays:MODulation:EVMagnitude:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{, <Start>,<Samples>}	with query	6.59
READ:ARRay:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.61
FETCh:ARRay:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.61
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.61
READ:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.62
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.62
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:AVERage?	0.0% to 100.0%	query only	6.62
DEFault:MODulation:EVMagnitude:QPSK:CONTrol	ON | OFF	with query	6.58
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.58
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.58
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.57
CONFigure:MODulation:EVMagnitude:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.57
READ:ARRay:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.61
FETCh:ARRay:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.61
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.61
READ:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.62
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.62
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:CURRent?	0.0% to 100.0%	query only	6.62
CONFigure:MODulation:EVMagnitude:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.56
CALCulate[:SCALar]:MODulation:EVMagnitude:QPSK:MATChing:LIMit?	<Result>	query only	6.60
READ:ARRay:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.61
FETCh:ARRay:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.61
SAMPle:ARRay:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.61
READ:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.62
FETCh:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.62
SAMPle:SUBarrays:MODulation:EVMagnitude:QPSK:MMAX?	0.0% to 100.0%	query only	6.62
FETCh:MODulation:EVMagnitude:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.57
READ[:SCALar]:MODulation:EVMagnitude:QPSK?	<Result>	query only	6.60
FETCh[:SCALar]:MODulation:EVMagnitude:QPSK?	<Result>	query only	6.60
SAMPle[:SCALar]:MODulation:EVMagnitude:QPSK?	<Result>	query only	6.60
INITiate:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.56
ABORt:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.56
STOP:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.56
CONTinue:MODulation:EVMagnitude:WCDMa:DPCH	–	no query	6.56

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.59
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.61
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.61
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.61
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.62
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:AVERage?	0.0% to 100.0%	query only	6.62
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH :AVERage?	0.0% to 100.0%	query only	6.62
DEFault:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.58
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH :CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.58
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.57
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:CONTrol :STATistics	1 to 1000 | NONE	with query	6.57
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.61
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.61
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.61
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.62
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:CURRent?	0.0% to 100.0%	query only	6.62
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH :CURRent?	0.0% to 100.0%	query only	6.62
CONFigure:MODulation:EVMagnitude:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.56
CALCulate[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH :MATChing:LIMit?	<Result>	query only	6.60
READ:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.61
FETCh:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.61
SAMPle:ARRay:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.61
READ:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.62
FETCh:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.62
SAMPle:SUBarrays:MODulation:EVMagnitude:WCDMa:DPCH:MMAX?	0.0% to 100.0%	query only	6.62
FETCh:MODulation:EVMagnitude:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.57
READ[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?	<Result>	query only	6.60
FETCh[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?	<Result>	query only	6.60
SAMPle[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH?	<Result>	query only	6.60
I/Q Analyzer (Non Signalling Only!)			
INITiate:MODulation:IQANalyzer:QPSK	–	no query	6.22
ABORt:MODulation:IQANalyzer:QPSK	–	no query	6.22
STOP:MODulation:IQANalyzer:QPSK	–	no query	6.22
CONTinue:MODulation:IQANalyzer:QPSK	–	no query	6.22
CONFigure:SUBarrays:MODulation:IQANalyzer:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.25
DEFault:MODulation:IQANalyzer:QPSK:CONTrol	ON | OFF	with query	6.24

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.23
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.23
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.23
CONFigure:MODulation:IQANalyzer:QPSK:CONTrol:ROTation	0 | 45	with query	6.24
CONFigure:MODulation:IQANalyzer:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.22
READ:ARRay:MODulation:IQANalyzer:QPSK:IPHase?	–180.0 deg to +180.0 deg	query only	6.26
FETCh:ARRay:MODulation:IQANalyzer:QPSK:IPHase?	–180.0 deg to +180.0 deg	query only	6.26
SAMPle:ARRay:MODulation:IQANalyzer:QPSK:IPHase?	–180.0 deg to +180.0 deg	query only	6.26
READ:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?	–180.0 deg to +180.0 deg	query only	6.27
FETCh:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?	–180.0 deg to +180.0 deg	query only	6.27
SAMPle:SUBarrays:MODulation:IQANalyzer:QPSK:IPHase?	–180.0 deg to +180.0 deg	query only	6.27
FETCh:MODulation:IQANalyzer:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.22
READ[:SCALar]:MODulation:IQANalyzer:QPSK?	<Result>	query only	6.26
FETCh[:SCALar]:MODulation:IQANalyzer:QPSK?	<Result>	query only	6.26
SAMPle[:SCALar]:MODulation:IQANalyzer:QPSK?	<Result>	query only	6.26
INITiate:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
ABORt:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
STOP:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
CONTinue:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
CONFigure:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.25
DEFault:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.24
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.23
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.23
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.22
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.26
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.26
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.26
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.27
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.27
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.27
FETCh:MODulation:IQANalyzer:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.22
READ[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.26
FETCh[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.26
SAMPle[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.26
Modulation Measurements – Magnitude Error			
INITiate:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
ABORt:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
STOP:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22
CONTinue:MODulation:IQANalyzer:WCDMa:DPCH	–	no query	6.22

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.25
DEFault:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.24
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, STEP | NONE	with query	6.23
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.23
CONFigure:MODulation:IQANalyzer:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.22
READ:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.26
FETCh:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.26
SAMPle:ARRay:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.26
READ:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.27
FETCh:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.27
SAMPle:SUBarrays:MODulation:IQANalyzer:WCDMa:DPCH:QPHase?	–180.0 deg to +180.0 deg	query only	6.27
FETCh:MODulation:IQANalyzer:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.22
READ[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.26
FETCh[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.26
SAMPle[:SCALar]:MODulation:IQANalyzer:WCDMa:DPCH?	<Result>	query only	6.26
INITiate:MODulation:MERRor:QPSK	–	no query	6.63
ABORt:MODulation:MERRor:QPSK	–	no query	6.63
STOP:MODulation:MERRor:QPSK	–	no query	6.63
CONTinue:MODulation:MERRor:QPSK	–	no query	6.63
CONFigure:SUBarrays:MODulation:MERRor:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.66
READ:ARRay:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.68
FETCh:ARRay:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.68
SAMPle:ARRay:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.68
READ:SUBarrays:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.69
FETCh:SUBarrays:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.69
SAMPle:SUBarrays:MODulation:MERRor:QPSK:AVERage?	–100.0% to +100.0%	query only	6.69
DEFault:MODulation:MERRor:QPSK:CONTrol	ON | OFF	with query	6.65
CONFigure:MODulation:MERRor:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.65
CONFigure:MODulation:MERRor:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.65
CONFigure:MODulation:MERRor:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.64
CONFigure:MODulation:MERRor:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.64
READ:ARRay:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.68
FETCh:ARRay:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.68
SAMPle:ARRay:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.68
READ:SUBarrays:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.69
FETCh:SUBarrays:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.69
SAMPle:SUBarrays:MODulation:MERRor:QPSK:CURRent?	–100.0% to +100.0%	query only	6.69
CONFigure:MODulation:MERRor:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.63

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CALCulate[:SCALar]:MODulation:MERRor:QPSK:MATChing:LIMit?	<Result>	query only	6.67
READ:ARRay:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.68
FETCh:ARRay:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.68
SAMPle:ARRay:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.68
READ:SUBarrays:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.69
FETCh:SUBarrays:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.69
SAMPle:SUBarrays:MODulation:MERRor:QPSK:MMAX?	–100.0% to +100.0%	query only	6.69
FETCh:MODulation:MERRor:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.64
READ[:SCALar]:MODulation:MERRor:QPSK?	<Result>	query only	6.67
FETCh[:SCALar]:MODulation:MERRor:QPSK?	<Result>	query only	6.67
SAMPle[:SCALar]:MODulation:MERRor:QPSK?	<Result>	query only	6.67
INITiate:MODulation:MERRor:WCDMa:DPCH	–	no query	6.63
ABORt:MODulation:MERRor:WCDMa:DPCH	–	no query	6.63
STOP:MODulation:MERRor:WCDMa:DPCH	–	no query	6.63
CONTinue:MODulation:MERRor:WCDMa:DPCH	–	no query	6.63
CONFigure:SUBarrays:MODulation:MERRor:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.66
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.68
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.68
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.68
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.69
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.69
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:AVERage?	–100.0% to +100.0%	query only	6.69
DEFault:MODulation:MERRor:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.65
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.65
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.64
CONFigure:MODulation:MERRor:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.64
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.68
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.68
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.68
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.69
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.69
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:CURRent?	–100.0% to +100.0%	query only	6.69
CONFigure:MODulation:MERRor:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.63
CALCulate[:SCALar]:MODulation:MERRor:WCDMa:DPCH:MATChing:LIMit?	<Result>	query only	6.67
READ:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.68
FETCh:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.68
SAMPle:ARRay:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.68
READ:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.69
FETCh:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.69
SAMPle:SUBarrays:MODulation:MERRor:WCDMa:DPCH:MMAX?	–100.0% to +100.0%	query only	6.69

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
FETCh:MODulation:MERRor:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.64
READ[:SCALar]:MODulation:MERRor:WCDMa:DPCH?	<Result>	query only	6.67
FETCh[:SCALar]:MODulation:MERRor:WCDMa:DPCH?	<Result>	query only	6.67
SAMPle[:SCALar]:MODulation:MERRor:WCDMa:DPCH?	<Result>	query only	6.67
Modulation Measurements – Common Settings			
CONFigure:MODulation:OEMP:QPSK:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>,<I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>	with query	6.53
CONFigure:MODulation:OEMP:QPSK:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>,<I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>	with query	6.52
DEFault:MODulation:OEMP:QPSK:LIMit	ON | OFF	with query	6.53
CONFigure:MODulation:OEMP:WCDMa:DPCH:AVERage:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>,<I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>, <Peak Code Domain Error>, <Transmit Time Error>	with query	6.53
CONFigure:MODulation:OEMP:WCDMa:DPCH:CMMax:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Error Vector Magn. (Peak)>, <Error Vector Magn. (RMS)>, <Magnitude Error (Peak)>, <Magnitude Error (RMS)>, <Phase Error (Peak)>, <Phase Error (RMS)>,<I/Q Origin Offset>, <I/Q Imbalance>, <Carrier Frequency Error>, <Waveform Quality>, <Peak Code Domain Error>, <Transmit Time Error>	with query	6.52
DEFault:MODulation:OEMP:WCDMa:DPCH:LIMit	ON | OFF	with query	6.53
Modulation Measurements - Overview			
INITiate:MODulation:OVERview:QPSK	–	no query	6.50
ABORt:MODulation:OVERview:QPSK	–	no query	6.50
STOP:MODulation:OVERview:QPSK	–	no query	6.50
CONTinue:MODulation:OVERview:QPSK	–	no query	6.50
DEFault:MODulation:OVERview:QPSK:CONTrol	ON | OFF	with query	6.52
CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.51

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:MODulation:OVERview:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.51
CONFigure:MODulation:OVERview:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.51
CONFigure:MODulation:OVERview:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.50
CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit?	<Result>	query only	6.55
FETCh:MODulation:OVERview:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.50
READ[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.54
INITiate:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
ABORt:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
STOP:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
CONTinue:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax :PCDE?	<Result>	query only	6.54
DEFault:MODulation:OVERview:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.52
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.51
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.51
CONFigure:MODulation:OVERview:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.50
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH :MATChing:LIMit?	<Result>	query only	6.55
FETCh:MODulation:OVERview:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.50
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.54
Modulation Measurements – Phase Error			
INITiate:MODulation:OVERview:QPSK	–	no query	6.50
ABORt:MODulation:OVERview:QPSK	–	no query	6.50
STOP:MODulation:OVERview:QPSK	–	no query	6.50
CONTinue:MODulation:OVERview:QPSK	–	no query	6.50
DEFault:MODulation:OVERview:QPSK:CONTrol	ON | OFF	with query	6.52
CONFigure:MODulation:OVERview:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.51
CONFigure:MODulation:OVERview:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.51
CONFigure:MODulation:OVERview:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.51
CONFigure:MODulation:OVERview:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.50
CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit?	<Result>	query only	6.55
FETCh:MODulation:OVERview:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.50

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
READ[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:OVERview:QPSK?	<Result>	query only	6.54
INITiate:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
ABORt:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
STOP:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
CONTinue:MODulation:OVERview:WCDMa:DPCH	–	no query	6.50
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH:CMMax:PCDE?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH :CMMax:PCDE?	<Result>	query only	6.54
DEFault:MODulation:OVERview:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.52
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.51
CONFigure:MODulation:OVERview:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.51
CONFigure:MODulation:OVERview:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.50
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH :MATChing:LIMit?	<Result>	query only	6.55
FETCh:MODulation:OVERview:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.50
READ[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.54
FETCh[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.54
SAMPle[:SCALar]:MODulation:OVERview:WCDMa:DPCH?	<Result>	query only	6.54
INITiate:MODulation:PERRor:QPSK	–	no query	6.70
ABORt:MODulation:PERRor:QPSK	–	no query	6.70
STOP:MODulation:PERRor:QPSK	–	no query	6.70
CONTinue:MODulation:PERRor:QPSK	–	no query	6.70
CONFigure:SUBarrays:MODulation:PERRor:QPSK	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{, <Start>,<Samples>}	with query	6.73
READ:ARRay:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.75
FETCh:ARRay:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.75
SAMPle:ARRay:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.75
READ:SUBarrays:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:SUBarrays:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:SUBarrays:MODulation:PERRor:QPSK:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
DEFault:MODulation:PERRor:QPSK:CONTrol	ON | OFF	with query	6.72
CONFigure:MODulation:PERRor:QPSK:CONTrol:MLENgth	640 | 2560	with query	6.72
CONFigure:MODulation:PERRor:QPSK:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.72
CONFigure:MODulation:PERRor:QPSK:CONTrol:RMODe	SCALar | ARRay	with query	6.71
CONFigure:MODulation:PERRor:QPSK:CONTrol:STATistics	1 to 1000 | NONE	with query	6.71
READ:ARRay:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.75
FETCh:ARRay:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.75
SAMPle:ARRay:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.75

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
READ:SUBarrays:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:SUBarrays:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:SUBarrays:MODulation:PERRor:QPSK:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
CONFigure:MODulation:PERRor:QPSK:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.70
CALCulate[:SCALar]:MODulation:PERRor:QPSK:MATChing:LIMit?	<Result>	query only	6.74
READ:ARRay:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.75
FETCh:ARRay:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.75
SAMPle:ARRay:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.75
READ:SUBarrays:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:SUBarrays:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:SUBarrays:MODulation:PERRor:QPSK:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:MODulation:PERRor:QPSK:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.71
READ[:SCALar]:MODulation:PERRor:QPSK?	<Result>	query only	6.74
FETCh[:SCALar]:MODulation:PERRor:QPSK?	<Result>	query only	6.74
SAMPle[:SCALar]:MODulation:PERRor:QPSK?	<Result>	query only	6.74
INITiate:MODulation:PERRor:WCDMa:DPCH	–	no query	6.70
ABORt:MODulation:PERRor:WCDMa:DPCH	–	no query	6.70
STOP:MODulation:PERRor:WCDMa:DPCH	–	no query	6.70
CONTinue:MODulation:PERRor:WCDMa:DPCH	–	no query	6.70
CONFigure:SUBarrays:MODulation:PERRor:WCDMa:DPCH	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.73
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.75
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.75
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.75
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:AVERage?	–180.0 deg to +180.0 deg	query only	6.76
DEFault:MODulation:PERRor:WCDMa:DPCH:CONTrol	ON | OFF	with query	6.72
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.72
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:RMODe	SCALar | ARRay	with query	6.71
CONFigure:MODulation:PERRor:WCDMa:DPCH:CONTrol:STATistics	1 to 1000 | NONE	with query	6.71
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.75
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.75
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.75
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:CURRent?	–180.0 deg to +180.0 deg	query only	6.76
CONFigure:MODulation:PERRor:WCDMa:DPCH:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.70
CALCulate[:SCALar]:MODulation:PERRor:WCDMa:DPCH:MATChing:LIMit?	<Result>	query only	6.74
READ:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.75
FETCh:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.75

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
SAMPle:ARRay:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.75
READ:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
SAMPle:SUBarrays:MODulation:PERRor:WCDMa:DPCH:MMAX?	–180.0 deg to +180.0 deg	query only	6.76
FETCh:MODulation:PERRor:WCDMa:DPCH:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.71
READ[:SCALar]:MODulation:PERRor:WCDMa:DPCH?	<Result>	query only	6.74
FETCh[:SCALar]:MODulation:PERRor:WCDMa:DPCH?	<Result>	query only	6.74
SAMPle[:SCALar]:MODulation:PERRor:WCDMa:DPCH?	<Result>	query only	6.74
CONFigure:MODulation:WCDMa:DPCH:CONTrol:CCMode	MANual | AUTomatic	with query	6.49
Power Measurements – Inner Loop TPC			
DEFault:POWer:CONTrol	ON | OFF	with query	6.35
INITiate:POWer:ILTPc	–	no query	6.41
ABORt:POWer:ILTPc	–	no query	6.41
STOP:POWer:ILTPc	–	no query	6.41
CONTinue:POWer:ILTPc	–	no query	6.41
DEFault:POWer:ILTPc:CONTrol	ON | OFF	with query	6.44
CONFigure:POWer:ILTPc:CONTrol:BSECtion	ON | OFF	with query	6.43
CONFigure:POWer:ILTPc:CONTrol:PLENgth	<ProfileLength>	with query, Sig. only	6.43
CONFigure:POWer:ILTPc:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.42
CONFigure:POWer:ILTPc:CONTrol:RMODe	SCALar | ARRay	with query	6.42
CONFigure:POWer:ILTPc:CONTrol:SANalysis	ON | OFF	with query	6.43
CONFigure:POWer:ILTPc:CONTrol:TPCControl	<ProfileLength>, <StepSize>, <TPCMode>	with query, NS only	6.43
CONFigure:POWer:ILTPc:CONTrol:TPCProfile:ALG<nr>	ON | OFF	with query	6.44
CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.46
READ[:SCALar]:POWer:ILTPc:CURRent?	<Result>	query only	6.46
FETCh[:SCALar]:POWer:ILTPc:CURRent?	<Result>	query only	6.46
SAMPle[:SCALar]:POWer:ILTPc:CURRent?	<Result>	query only	6.46
CONFigure:POWer:ILTPc:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.41
DEFault:POWer:ILTPc:LIMit	ON | OFF	with query	6.45
FETCh:POWer:ILTPc:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE	query only	6.41
CONFigure:POWer:ILTPc:STEP:CURRent:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<MaxThreshold>,<MinThreshold>	with query	6.45
CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.47
READ:ARRay:POWer:ILTPc:STEP:CURRent?	–100.0 dB to +100.0 dB	query only	6.47
FETCh:ARRay:POWer:ILTPc:STEP:CURRent?	–100.0 dB to +100.0 dB	query only	6.47
SAMPle:ARRay:POWer:ILTPc:STEP:CURRent?	–100.0 dB to +100.0 dB	query only	6.47
CONFigure:POWer:ILTPc:THReshold:CURRent:LIMit[:SCALar]:ASYMmetric[:COMBined]:VALue	<MaxThreshold>,<MinThreshold>	with query	6.44
CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.48
READ:ARRay:POWer:ILTPc:UEPower:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.47
FETCh:ARRay:POWer:ILTPc:UEPower:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.47

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
SAMPle:ARRay:POWer:ILTPc:UEPower:CURRent?	–100.0 dBm to +60.0 dBm	query only	6.47
DEFault:POWer:LIMit	ON | OFF	with query	6.38
Power Measurements – Maximum			
INITiate:POWer:MAXimum	–	no query	6.32
ABORt:POWer:MAXimum	–	no query	6.32
STOP:POWer:MAXimum	–	no query	6.32
CONTinue:POWer:MAXimum	–	no query	6.32
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:LOWer:VALue	<Lower_Limit_Peak>,<Lower_Limit_RMS>	with query	6.36
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:RVALue	<Rated_Value_Peak>,<Rated_Value_RMS>	with query	6.37
CONFigure:POWer:MAXimum:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.36
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:LOWer:VALue	<Lower_Limit_Peak>,<Lower_Limit_RMS>	with query	6.36
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:RVALue	<Rated_Value_Peak>,<Rated_Value_RMS>	with query	6.36
CONFigure:POWer:MAXimum:CMMax:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.35
DEFault:POWer:MAXimum:CONTrol	ON | OFF	with query	6.35
CONFigure:POWer:MAXimum:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.34
CONFigure:POWer:MAXimum:CONTrol:STATistics	1 to 1000 | NONE	with query	6.34
CONFigure:POWer:MAXimum:CONTrol:TPControl	AUTO | MANual	with query	6.34
CONFigure:POWer:MAXimum:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.33
DEFault:POWer:MAXimum:LIMit	ON | OFF	with query	6.37
CALCulate[:SCALar]:POWer:MAXimum:MATChing:LIMit?	Evaluation periodPwCurrRMS, LeakPowRMS	query only	6.40
FETCh:POWer:MAXimum:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.33
READ[:SCALar]:POWer:MAXimum?	<Result>	query only	6.39
FETCh[:SCALar]:POWer:MAXimum?	<Result>	query only	6.39
SAMPle[:SCALar]:POWer:MAXimum?	AvgEvaluation periodPower, PeakEvaluation periodPower, Evaluation periodsOutOfTol, Evaluation periodMatching	query only	6.39
Power Measurements – Minimum			
INITiate:POWer:MINimum	–	no query	6.32
ABORt:POWer:MINimum	–	no query	6.32
STOP:POWer:MINimum	–	no query	6.32
CONTinue:POWer:MINimum	–	no query	6.32
CONFigure:POWer:MINimum:AVERage:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.38
CONFigure:POWer:MINimum:CMAX:LIMit[:SCALar]:SYMmetric[:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.37
DEFault:POWer:MINimum:CONTrol	ON | OFF	with query	6.35

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:POWer:MINimum:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.34
CONFigure:POWer:MINimum:CONTrol:STATistics	1 to 1000 | NONE	with query	6.34
CONFigure:POWer:MINimum:CONTrol:TPControl	AUTO | MANual	with query	6.34
CONFigure:POWer:MINimum:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.33
DEFault:POWer:MINimum:LIMit	ON | OFF	with query	6.38
CALCulate[:SCALar]:POWer:MINimum:MATChing:LIMit?	Evaluation periodPwCurrRMS, LeakPowRMS	query only	6.40
FETCh:POWer:MINimum:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.33
READ[:SCALar]:POWer:MINimum?	<Result>	query only	6.39
FETCh[:SCALar]:POWer:MINimum?	<Result>	query only	6.39
SAMPle[:SCALar]:POWer:MINimum?	AvgEvaluation periodPower, PeakEvaluation periodPower, Evaluation periodsOutOfTol, Evaluation periodMatching	query only	6.39
Power Measurements – Off			
INITiate:POWer:OFF	–	no query	6.32
ABORt:POWer:OFF	–	no query	6.32
STOP:POWer:OFF	–	no query	6.32
CONTinue:POWer:OFF	–	no query	6.32
CONFigure:POWer:OFF:AVERage:LIMit[:SCALar]:SYMmetric [:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.38
CONFigure:POWer:OFF:CMAX:LIMit[:SCALar]:SYMmetric [:COMBined]:VALue	<Upper_Limit_Peak>,<Upper_Limit_RMS>	with query	6.37
DEFault:POWer:OFF:CONTrol	ON | OFF	with query	6.35
CONFigure:POWer:OFF:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE,STEP | NONE	with query	6.34
CONFigure:POWer:OFF:CONTrol:STATistics	1 to 1000 | NONE	with query	6.34
CONFigure:POWer:OFF:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.33
DEFault:POWer:OFF:LIMit	ON | OFF	with query	6.38
CALCulate[:SCALar]:POWer:OFF:MATChing:LIMit?	Evaluation periodPwCurrRMS, LeakPowRMS	query only	6.40
FETCh:POWer:OFF:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.33
READ[:SCALar]:POWer:OFF?	<Result>	query only	6.39
FETCh[:SCALar]:POWer:OFF?	<Result>	query only	6.39
SAMPle[:SCALar]:POWer:OFF?	AvgEvaluation periodPower, PeakEvaluation periodPower, Evaluation periodsOutOfTol, Evaluation periodMatching	query only	6.39
Power Measurements – P/Slot Table (Non Signalling only!)			
INITiate:POWer:XSLot	–	no query	6.19
ABORt:POWer:XSLot	–	no query	6.19
STOP:POWer:XSLot	–	no query	6.19

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONTinue:POWer:XSLot	–	no query	6.19
DEFault:POWer:XSLot:CONTrol	ON | OFF	with query	6.21
CONFigure:POWer:XSLot:CONTrol:PMWidth	0.25 | 0.50 | 1.00	with query	6.20
CONFigure:POWer:XSLot:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 1000, SONerror | NONE, STEP | NONE	with query	6.20
CONFigure:POWer:XSLot:CONTrol:SCOunt	1 to 100	with query	6.20
CONFigure:POWer:XSLot:CONTrol:SDELay	1 to 100	with query	6.21
CONFigure:POWer:XSLot:CONTrol:SWIDth	1 to 15	with query	6.20
READ[:SCALar]:POWer:XSLot:CURRent?	<Result>	query only	6.21
FETCh[:SCALar]:POWer:XSLot:CURRent?	<Result>	query only	6.21
SAMPle[:SCALar]:POWer:XSLot:CURRent?	<Result>	query only	6.21
CONFigure:POWer:XSLot:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.19
FETCh:POWer:XSLot:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.19
Receiver Quality Measurement			
INITiate:RXQuality:BER	–	no query	6.110
ABORt:RXQuality:BER	–	no query	6.110
STOP:RXQuality:BER	–	no query	6.110
CONTinue:RXQuality:BER	–	no query	6.110
DEFault:RXQuality:BER:CONTrol	ON | OFF	with query	6.112
CONFigure:RXQuality:BER:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 1000, SONerror | NONE, STEP | NONE	with query	6.111
CONFigure:RXQuality:BER:CONTrol:TBLocks	1 to 50000	with query	6.111
CONFigure:RXQuality:BER:CONTrol:TBSize		with query, NS only	6.111
CONFigure:RXQuality:BER:CONTrol:Timing	876 to 1172	with query, NS only	6.112
CONFigure:RXQuality:BER:CURRent:LIMit[:SCALar]:ASYMmetric :UPPer:VALue	0 % to 100 %, 0 % to 100 %	with query	6.112
CONFigure:RXQuality:BER:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.110
DEFault:RXQuality:BER:LIMit	ON | OFF	with query	6.112
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?	<Result>	query only	6.113
FETCh:RXQuality:BER:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.110
READ[:SCALar]:RXQuality:BER?	<Result>	query only	6.113
FETCh[:SCALar]:RXQuality:BER?	<Result>	query only	6.113
SAMPle[:SCALar]:RXQuality:BER?	<Result>	query only	6.113
Receiver Quality Measurement: UE Reports			
INITiate:RXQuality:UEReport	–	no query	6.114
ABORt:RXQuality:UEReport	–	no query	6.114
DEFault:RXQuality:UEReport:CONTrol	ON | OFF	with query	6.115
CONFigure:RXQuality:UEReport:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.114
FETCh:RXQuality:UEReport:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.114
CONFigure:RXQuality:UEReport<nr>:ENABle	ON | OFF	with query	6.114

Command (Measurements, Non Sig. and Signalling) [illegible]	**Parameter**	**Remark**	**Page**
[SENSe:]RXQuality:UEReport<nr>?	<Result>	with query	6.115
Spectrum Measurement – Emission Mask			
CONFigure:SPECtrum:CONTrol:HDYNamic	ON | OFF	with query	6.80
INITiate:SPECtrum:EMASk	–	no query	6.92
ABORt:SPECtrum:EMASk	–	no query	6.92
STOP:SPECtrum:EMASk	–	no query	6.92
CONTinue:SPECtrum:EMASk	–	no query	6.92
CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:ABSolute:AVERage:LIMit:LINE :SYMmetric:[COMBined]:VALue	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:ABSolute:CMAX:LIMit:LINE :SYMmetric:[COMBined]:VALue	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.96
CONFigure:SPECtrum:EMASk:ADDition:AVERage:LIMit:LINE :SYMmetric:[COMBined]:VALue	<Limit_1MHz>, <Limit_30kHz>	with query	6.95
CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.96
CONFigure:SPECtrum:EMASk:ADDition:CMAX:LIMit:LINE :SYMmetric:[COMBined]:VALue	<Limit_1MHz>, <Limit_30kHz>	with query	6.95
CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.98
READ:ARRay:SPECtrum:EMASk:AVERage?	–100.0 dB to 0.0 dB	query only	6.97
FETCh:ARRay:SPECtrum:EMASk:AVERage?	–100.0 dB to 0.0 dB	query only	6.97
SAMPle:ARRay:SPECtrum:EMASk:AVERage?	–100.0 dB to 0.0 dB	query only	6.97
DEFault:SPECtrum:EMASk:CONTrol	ON | OFF	with query	6.94
CONFigure:SPECtrum:EMASk:CONTrol:MLENgth	320 | 640 | 1280 | 2560	with query	6.94
CONFigure:SPECtrum:EMASk:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.93
CONFigure:SPECtrum:EMASk:CONTrol:RMODe	SCALar | ARRay	with query	6.93
CONFigure:SPECtrum:EMASk:CONTrol:STATistics	1 to 1000 | NONE	with query	6.93
CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.98
READ:ARRay:SPECtrum:EMASk:CURRent?	–100.0 dB to 0.0 dB	query only	6.97
FETCh:ARRay:SPECtrum:EMASk:CURRent?	–100.0 dB to 0.0 dB	query only	6.97
SAMPle:ARRay:SPECtrum:EMASk:CURRent?	–100.0 dB to 0.0 dB	query only	6.97
CONFigure:SPECtrum:EMASk:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.92
DEFault:SPECtrum:EMASk:LIMit:LINE	ON | OFF	with query	6.96
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.98
READ:ARRay:SPECtrum:EMASk:MAXimum?	–100.0 dB to 0.0 dB	query only	6.97
FETCh:ARRay:SPECtrum:EMASk:MAXimum?	–100.0 dB to 0.0 dB	query only	6.97
SAMPle:ARRay:SPECtrum:EMASk:MAXimum?	–100.0 dB to 0.0 dB	query only	6.97
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:RELative:AVERage:LIMit:LINE :SYMmetric:[COMBined]:VALue	<Limit>	with query	6.94

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE :SYMmetric:[COMBined]:ENABle	<Limit>	with query	6.95
CONFigure:SPECtrum:EMASk:RELative:CMAX:LIMit:LINE :SYMmetric:[COMBined]:VALue	<Limit>	with query	6.94
FETCh:SPECtrum:EMASk:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.92
READ[:SCALar]:SPECtrum:EMASk?	<Result>	query only	6.97
FETCh[:SCALar]:SPECtrum:EMASk?	<Result>	query only	6.97
SAMPle[:SCALar]:SPECtrum:EMASk?	<Result>	query only	6.97
Spectrum Measurement – ACLR FFT/OBW			
INITiate:SPECtrum:MFFT	–	no query	6.84
ABORt:SPECtrum:MFFT	–	no query	6.84
STOP:SPECtrum:MFFT	–	no query	6.84
CONTinue:SPECtrum:MFFT	–	no query	6.84
CONFigure:SPECtrum:MFFT:ABSolute:AVERage:LIMit[:SCALar] :ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.87
CONFigure:SPECtrum:MFFT:ABSolute:CMAX:LIMit[:SCALar] :ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.87
CONFigure:SPECtrum:MFFT:ABSolute:LIMit[:SCALar] :ASYMmetric:UPPer:Enable <Enable>	<ACLR_Limit	with query	6.87
READ[:SCALar]:SPECtrum:MFFT:ABSolute?	<Result>	query only	6.89
FETCh[:SCALar]:SPECtrum:MFFT:ABSolute?	<Result>	query only	6.89
SAMPle[:SCALar]:SPECtrum:MFFT:ABSolute?	<Result>	query only	6.89
DEFault:SPECtrum:MFFT:CONTrol	ON | OFF	with query	6.86
CONFigure:SPECtrum:MFFT:CONTrol:MLENgth	320 | 640 | 1280 | 2560	with query	6.86
CONFigure:SPECtrum:MFFT:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.85
CONFigure:SPECtrum:MFFT:CONTrol:RMODe	SCALar | ARRay	with query	6.85
CONFigure:SPECtrum:MFFT:CONTrol:STATistics	1 to 1000 | NONE	with query	6.85
CONFigure:SPECtrum:MFFT:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.84
DEFault:SPECtrum:MFFT:LIMit	ON | OFF	with query	6.87
CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.89
CONFigure:SPECtrum:MFFT:OBW:AVERage:LIMit[:SCALar] :ASYMmetric:UPPer:VALue	<OBW_Limit>	with query	6.87
CONFigure:SPECtrum:MFFT:OBW:CMAX:LIMit[:SCALar] :ASYMmetric:UPPer:VALue	<OBW_Limit>	with query	6.87
CONFigure:SPECtrum:MFFT:OBW:LIMit[:SCALar] :ASYMmetric:UPPer:Enable	ON | OFF	with query	6.87
CONFigure:SPECtrum:MFFT:RELative:AVERage:LIMit[:SCALar] :ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.86
CONFigure:SPECtrum:MFFT:RELative:CMAX:LIMit[:SCALar] :ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.86
CONFigure:SPECtrum:MFFT:RELative:LIMit[:SCALar] :ASYMmetric:UPPer:CHANnel<nr>:Enable	ON | OFF	with query	6.86
READ[:SCALar]:SPECtrum:MFFT:RELative?	<Result>	query only	6.89
FETCh[:SCALar]:SPECtrum:MFFT:RELative?	<Result>	query only	6.89
SAMPle[:SCALar]:SPECtrum:MFFT:RELative?	<Result>	query only	6.89

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
FETCh:SPECtrum:MFFT:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.84
CONFigure:SUBarrays:SPECtrum:MFFT:WFSPectrum	ALL | ARIThmetical | MINimum | QPSK,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.88
READ:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.90
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.90
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.90
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.91
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.91
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:AVERage?	–100.0 dB to 0.0 dB	query only	6.91
READ:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.90
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.90
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.90
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.91
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.91
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.91
READ:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.90
FETCh:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.90
SAMPle:ARRay:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.90
READ:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.91
FETCh:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.91
SAMPle:SUBarrays:SPECtrum:MFFT:WFSPectrum:MAXimum?	–100.0 dB to 0.0 dB	query only	6.91
CONFigure:SUBarrays:SPECtrum:MFFT:WFSSpectrum	ALL | ARIThmetical | MINimum | MAXimum,<Start>,<Samples>{,<Start>,<Samples>}	with query	6.88
READ:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.90
FETCh:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.90
SAMPle:ARRay:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.90
READ:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.91
FETCh:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.91
SAMPle:SUBarrays:SPECtrum:MFFT:WFSSpectrum:CURRent?	–100.0 dB to 0.0 dB	query only	6.91
Spectrum Measurement – ACLR Filter			
INITiate:SPECtrum:MFILter	–	no query	6.77
ABORt:SPECtrum:MFILter	–	no query	6.77
STOP:SPECtrum:MFILter	–	no query	6.77
CONTinue:SPECtrum:MFILter	–	no query	6.77
CONFigure:SPECtrum:MFILter:ABSolute:LIMit[:SCALar]:ASYMmetric:UPPer:Enable	ON | OFF	with query	6.81
READ[:SCALar]:SPECtrum:MFILter:ABSolute?	<Result>	query only	6.82
FETCh[:SCALar]:SPECtrum:MFILter:ABSolute?	<Result>	query only	6.82
SAMPle[:SCALar]:SPECtrum:MFILter:ABSolute?	<Result>	query only	6.82
CONFigure:SPECtrum:MFILter:APEak:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.81
CONFigure:SPECtrum:MFILter:ARMS:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.81

Command (Measurements, Non Sig. and Signalling)	Parameter	Remark	Page
CONFigure:SPECtrum:MFILter:ARMS:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:VALue	<ACLR_Limit>	with query	6.81
DEFault:SPECtrum:MFILter:CONTrol	ON | OFF	with query	6.79
CONFigure:SPECtrum:MFILter:CONTrol:MLENgth	320 | 640 | 1280 | 2560	with query	6.79
CONFigure:SPECtrum:MFILter:CONTrol:REPetition	CONTinuous | SINGleshot | 1 to 10000, SONerror | NONE, STEP | NONE	with query	6.79
CONFigure:SPECtrum:MFILter:CONTrol:STATistics	1 to 1000 | NONE	with query	6.78
CONFigure:SPECtrum:MFILter:CONTrol:UEPMeasure	ON | OFF	with query	6.79
CONFigure:SPECtrum:MFILter:EREPorting	SRQ | SOPC | SRSQ | OFF	with query	6.77
DEFault:SPECtrum:MFILter:LIMit	ON | OFF	with query	6.81
CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMit?	NMAU | NMAL | INV | OK	query only	6.83
DEFault:SPECtrum:MFILter:MEASx	ON | OFF	with query	6.82
CONFigure:SPECtrum:MFILter:MEASx:CHANnel<nr>:ENABle <Enable>	ON | OFF	with query	6.81
CONFigure:SPECtrum:MFILter:RELative:LIMit[:SCALar]:ASYMmetric:UPPer:CHANnel<nr>:ENABle	ON | OFF	with query	6.80
READ[:SCALar]:SPECtrum:MFILter:RELative?	<Result>	query only	6.82
FETCh[:SCALar]:SPECtrum:MFILter:RELative?	<Result>	query only	6.82
SAMPle[:SCALar]:SPECtrum:MFILter:RELative?	<Result>	query only	6.82
CONFigure:SPECtrum:MFILter:RPEak:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit>	with query	6.80
CONFigure:SPECtrum:MFILter:RRMS:AVERage:LIMit[:SCALar]:ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit	>with query	6.80
CONFigure:SPECtrum:MFILter:RRMS:CURRent:LIMit[:SCALar]:ASYMmetric:UPPer:CHANnel<nr>:VALue	<ACLR_Limit	>with query	6.80
FETCh:SPECtrum:MFILter:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 10000 | NONE , 1 to 1000 | NONE	query only	6.78

Table 6-2 Remote-control commands: General settings (available in Non Sign. and Signalling)

Command (General settings, Non Sign. and Sign.)	Parameters	Remark	Page
MMEMory			
MMEMory:RECall:CURRent	<FileName> [,<msus>]	no query	6.29
MMEMory:SAVE:CURRent	<FileName> [,<msus>]	no query	6.28
Options Query			
SYSTem:OPTions:INFO:CURRent?		query only	6.29
System Reset			
SYSTem:RESet:CURRent		no query	6.29

Table 6-3 Remote-control commands: Connection Control (available in Non Signalling)

Command (Connection Control, Non Signalling)	Parameters	Remark	Page
Inputs and Outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.16
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.16
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.16
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	–50 dB to +90 dB	with query	6.16
SOURce:DM:CLOCk:FREQuency	0.960 MHz to 30.720 MHz	with query	6.17
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.17
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.16
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.16
I/Q-IF Interface			
DEFault:IQIF	ON | OFF	with query	6.31
[SENSe:]:IQIF:LEVel?	< 0 dB	with query	6.31
CONFigure:IQIF:RXPath	BYP | BYIQ | XOIO | IOIO | IOXO	with query	6.30
CONFigure:IQIF:RXTXcombined	BYP | BYIQ | XOIO | IOIO | IOXO | FPAT | UDEF	with query	6.30
CONFigure:IQIF:TXPath	BYP | BYIQ | XOIO | IOIO | IOXO	with query	6.31
Input Level			
DEFault:LEVel	ON | OFF	with query	6.2
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.2
[SENSe:]LEVel:MAXimum	<Level>	with query	6.1
[SENSe:]LEVel:MODE	MANual | AUTO	with query	6.1
RF Analyzer Settings			
[SENSe:]RFANalyzer:FOFFset	–100 kHz to +100 kHz	with query	6.3
[SENSe:]RFANalyzer:FREQuency	15 MHz to 2700 MHz	with query	6.2
UNIT:RFANalyzer:FREQuency	HZ | KHZ | MHZ | GHZ | CH	with query	6.3
RF Generator Settings			
INITiate:RFGenerator	–	no query	6.3
ABORt:RFGenerator	–	no query	6.3
DEFault:RFGenerator	ON | OFF	with query	6.3
DEFault:RFGenerator:DBCHannel	ON | OFF	with query	6.9
SOURce:RFGenerator:DBCHannel:DPDCh:CODE	2 to 511	with query	6.8
SOURce:RFGenerator:DBCHannel:DPDCh:MODE	TGPP | PHYS	with query	6.8
SOURce:RFGenerator:DBCHannel:LEVel:DPDCh	–35 dB to +15 dB | OFF	with query	6.8
SOURce:RFGenerator:DBCHannel:LEVel:PCCPch	–35 dB to +15 dB | OFF	with query	6.8
SOURce:RFGenerator:DBCHannel:LEVel:PICH	–35 dB to +15 dB | OFF	with query	6.8
SOURce:RFGenerator:DBCHannel:PICH:CODE	2 to 255	with query	6.9
SOURce:RFGenerator:DBCHannel:POFFset	0.0 dB to 6.0 dB	with query	6.9
SOURce:RFGenerator:DBCHannel:TSTate	0 to 16	with query	6.9
SOURce:RFGenerator:FOFFset	–100 kHz to 100 kHz	with query	6.4
SOURce:RFGenerator:FREQuency	10 MHz to 2700 MHz	with query	6.4
UNIT:RFGenerator:FREQuency	HZ | KHZ | MHZ | GHZ | CH	with query	6.4
SOURce:RFGenerator:LREFerence	PCPich | OPOWer	with query	6.5
SOURce:RFGenerator:OCNS	–35 dB to +15 dB | OFF	with query	6.5
SOURce:RFGenerator:OPOWer	<Level>	with query	6.5

Command (Connection Control, Non Signalling)	Parameters	Remark	Page
DEFault:RFGenerator:PCHannel	ON | OFF	with query	6.11
SOURce:RFGenerator:PCHannel:DSOurce	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.11
SOURce:RFGenerator:PCHannel:SFORmat	0 to 16	with query	6.10
SOURce:RFGenerator:PHYSical:LEVel	*<P-CPICH_rel> | <P-CPICH_abs>, <P-SCH>, <S-SCH>, <P-CCPCH>, <PICH>, <DPCH>, <P-SCH>, <Power Offset>*	with query	6.6
DEFault:RFGenerator:RCHannel	ON | OFF	with query	6.10
SOURce:RFGenerator:RCHannel:DPDCh:TYPE	12.2 | 64 | 144 | 384	with query	6.9
SOURce:RFGenerator:RCHannel:SDCCh	PREDefined	query only	6.10
SOURce:RFGenerator:RCHannel:SDTCh	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.10
SOURce:RFGenerator:RCHannel:TBITs	0 to 16	with query	6.10
SOURce:RFGenerator:SCHannel:LEVel:PCPich	<Level_abs> | <Level_rel>	with query	6.7
SOURce:RFGenerator:SCHannel:LEVel:PSCH	–35 dB to +15 dB | OFF	with query	6.7
SOURce:RFGenerator:SCHannel:LEVel:SSCH	–35 dB to +15 dB | OFF	with query	6.7
SOURce:RFGenerator:SCODe:PRIMary	000 to 1FF	with query	6.4
SOURce:RFGenerator:SCODe:SECondary	0 to F	with query	6.5
FETCh:RFGenerator:STATus?	OFF | RUN | ERR	query only	6.3
DEFault:RFGenerator:TPC	ON | OFF	with query	6.12
SOURce:RFGenerator:TPC:PATTern<nr>	3 bits to 22 bits	with query	6.12
SOURce:RFGenerator:TPC:PTYPe	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.11
SOURce:RFGenerator:TPC:PTYPe<nr>	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR15	with query	6.12
SOURce:RFGenerator:TPC:RPATtern	ON	with query	6.12
Trigger			
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.18
TRIGger[:SEQuence]:DELay	0 to 14, –2559.75 to +2559.75	with query	6.17
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	with query	6.18
TRIGger[:SEQuence]:SOURce	FRUN | EXTern | INTern | IFPower	with query	6.17
TRIGger[:SEQuence]:THReshold:IFPower	<Threshold>	with query	6.18
UE Code			
CONFigure:UECode:AMODe	WOOF | WIOF	with query	6.13
DEFault:UECode:DPCH	ON | OFF	with query	6.14
CONFigure:UECode:DPCH:CMODe	0 | 1	with query	6.14
CONFigure:UECode:DPCH:SCODe	0 to FFFFFF	with query	6.13
CONFigure:UECode:DPCH:SFORmat	0 to 5	with query	6.13
CONFigure:UECode:DPCH:SNUMber	0 to 14	with query	6.14
CONFigure:UECode:DPCH:SYMode	ASL | SYNC	with query	6.13
DEFault:UECode:DPDCh	ON | OFF	with query	6.15
CONFigure:UECode:DPDCh:AUTO:SRATe	15 | 30 | 60 | 120 | 240 | 480 | 960	with query	6.14
CONFigure:UECode:DPDCh:AUTO:THReshold	–25 dB to +10 dB	with query	6.14
CONFigure:UECode:DPDCh:MANual:DPDCh1:SRCCode	<Rate>,<Code>	with query	6.15
CONFigure:UECode:DPDCh:MANual:MSIGnal	0 to 6	with query	6.15

Table 6-4 Remote-control commands: Connection Control (available in Signalling)

Command (Connection Control, Signalling)	Parameter	Remark	Page
BSSignal – Base Station Signal			
DEFault:BSSignal	ON | OFF	with query	6.131
CONFigure:BSSignal:CHANnel	2112.4 MHz to 2167.6 MHz | 1932.4 MHz to 1987.6 MHz | 1807.4 MHz to 1877.6	with query	6.129
UNIT:BSSignal:CHANnel	HZ | KHZ | MHZ | GHZ | CH	with query	6.129
CONFigure:BSSignal:DCH:RMC: SDTCh	ALL0 | ALL1 | ALT | PR9 | PR11 | PR13 | PR152	with query	6.133
CONFigure:BSSignal:DCH:RMC:DLRessource	P1000 | ... | P0031	with query	6.132
CONFigure:BSSignal:DCH:RMC:RTYPe	12.2 | 64 | 144 |	with query	6.132
CONFigure:BSSignal:DCH:RMC:TMODe	ON | OFF | MODE2	with query	6.133
CONFigure:BSSignal:DCH:RMC:UCRC	ON | OFF	with query	6.132
CONFigure:BSSignal:DCH:SRAB:SRB	K2_5 | K3_4 | K13_6	with query	6.134
CONFigure:BSSignal:DCH:TYPE	SRAB | RMC | VOIC	with query	6.132
CONFigure:BSSignal:DCH:VOICe:ACSet	A to H, M	with query	6.134
CONFigure:BSSignal:DCH:VOICe:SOURce	ECHO | OFF	with query	6.133
DEFault:BSSignal:DCHannel	ON | OFF	with query	6.134
CONFigure:BSSignal:FOFFset	–100 kHz to 100 kHz	with query	6.129
CONFigure:BSSignal:LREFerence	PCPich | OPOWer	with query	6.130
CONFigure:BSSignal:OCNS	–35 dB to +15 dB | OFF	with query	6.130
CONFigure:BSSignal:OPOWer	<Level>	with query	6.130
DEFault:BSSignal:PHYSical	ON | OFF	with query	6.137
CONFigure:BSSignal:PHYSical:CODE:DPDCh	2 to 511	with query	6.137
CONFigure:BSSignal:PHYSical:DPCH:POFFset	0.0 dB to 6.0 dB	with query	6.137
SOURce:BSSignal:PHYSical:LEVel	<P-CPICH_rel> | <P-CPICH_abs>, <P-SCH>, <S-SCH>, <P-CCPCH>, <S-CCPCH>, <PICH>, <AICH>, <DPCH>, <P-SCH>, <Power Offset>	with query	6.130
CONFigure:BSSignal:PHYSical:LEVel:AICH	–35 dB to +15 dB | OFF	with query	6.136
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary	–35 dB to +15 dB | OFF	with query	6.135
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary	–35 dB to +15 dB | OFF	with query	6.136
CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary	<Level_abs> | <Level_rel>	with query	6.135
CONFigure:BSSignal:PHYSical:LEVel:DPDCh	–35 dB to +15 dB | OFF	with query	6.136
CONFigure:BSSignal:PHYSical:LEVel:PICH	–35 dB to +15 dB | OFF	with query	6.136
CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary	–35 dB to +15 dB | OFF	with query	6.135
CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary	–35 dB to +15 dB | OFF	with query	6.135
CONFigure:BSSignal:SCODe:PRIMary	000 to 1FF	with query	6.129
CONFigure:BSSignal:SCODe:SECondary	0 to F	with query	6.137
DEFault:BSSignal:TPC	ON | OFF	with query	6.139
CONFigure:BSSignal:TPC:MODE	ALG1 | ALG2	with query	6.138
CONFigure:BSSignal:TPC:PATTern<nr>	3 bits to 22 bits	with query	6.139
CONFigure:BSSignal:TPC:PSET	SET1 | SET2 | SET3 | SET4 | SET5	with query	6.138
CONFigure:BSSignal:TPC:PTYPe<nr>	ALL0 | ALL1 | ALT | SPA0 | SPA1| SPAL | CLOP	with query	6.139
CONFigure:BSSignal:TPC:RPATtern	ON	with query	6.139
CONFigure:BSSignal:TPC:SSIZE	1 dB | 2 dB	with query	6.138
Handover			

Command (Connection Control, Signalling)	Parameter	Remark	Page
STATus:HANDover:TARGet:LIST?	<List>	query only	6.120
CONFigure:HANDover:TARGetPREPare	ON | OFF	with query	6.120
Inputs and outputs			
[SENSe:]CORRection:LOSS:INPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.145
SOURce:CORRection:LOSS:INPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.145
[SENSe:]CORRection:LOSS:OUTPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.145
SOURce:CORRection:LOSS:OUTPut<nr>[:MAGNitude]	-50 dB to 50 dB	with query	6.145
SOURce:DM:CLOCk:FREQuency	1.2190 MHz to 39.000 MHz	with query	6.146
SOURce:DM:CLOCk:STATe	ON | OFF	with query	6.146
INPut[:STATe]	RF1 | RF2 | RF4	with query	6.144
OUTPut[:STATe]	RF1 | RF2 | RF3	with query	6.145
LEVel – Analyzer Level			
[SENSe:]LEVel:ATTenuation	NORMal | LNOise | LDIStortion	with query	6.148
DEFault:LEVel:DEFault	ON | OFF	with query	6.148
[SENSe:]LEVel:MAXimum	<Level>	with query	6.148
[SENSe:]LEVel:MODE	MANual | PCLevel | AUTomatic	with query	6.148
Message Recorder			
CONFigure:MMONitor:IPADdress	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.149
CONFigure:MMONitor:IPADdress	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.150
CONFigure:MMONitor:LOGging	ON | OFF	with query	6.149
CONFigure:MMONitor:SMASk	1 to 255, 1 to 255, 1 to 255, 1 to 255	with query	6.149
NETWork – Network Parameters			
DEFault:NETWork:IDENtity	ON | OFF	with query	6.141
CONFigure:NETWork:IDENtity:LAC	1 to 65533 and 65535	with query	6.141
CONFigure:NETWork:IDENtity:MCC	0 to 999	with query	6.140
CONFigure:NETWork:IDENtity:MNC	0 to 99 | 0 to 999	with query	6.140
CONFigure:NETWork:IDENtity:MNC:DIGits	TWO | THR	with query	6.140
CONFigure:NETWork:IDENtity:URA	<16-digit binary>	with query	6.141
CONFigure:NETWork:OBANd	OB1 | OB2 | OB3	with query	6.140
CONFigure:NETWork:RAC:DRXCycle	6 to 9	with query	6.142
CONFigure:NETWork:RAC:PREamble:MCYCles	1 to 32	with query	6.141
CONFigure:NETWork:RAC:PREamble:MRETrans	1 to 8	with query	6.142
CONFigure:NETWork:RAC:PREamble:RAC:POFFset	1 to 8	with query	6.142
CONFigure:NETWork:RAC:PREamble:SSIZe	1 to 8	with query	6.142
CONFigure:NETWork:RAC:PREamble:TAICh	1 to 8	with query	6.142
CONFigure:NETWork:RAC:TTI	T10 | T20	with query	6.141
DEFault:NETWork:REQuest	ON | OFF	with query	6.144
CONFigure:NETWork:REQuest:ACAPability	ON | OFF	with query	6.143
CONFigure:NETWork:REQuest:AUTHenticat	ON | OFF	with query	6.143
CONFigure:NETWork:REQuest:HACTime	5 to 50 (frames)	with query	6.144
CONFigure:NETWork:REQuest:IMEI	ON | OFF	with query	6.143
CONFigure:NETWork:REQuest:RRCC	ON | OFF	with query	6.144
CONFigure:NETWork:REQuest:SECurity	ON | OFF	with query	6.143
Open Loop Power Measurement			
INITiate:OLP	–	no query	6.118

Command (Connection Control, Signalling)	Parameter	Remark	Page
ABORt:OLP	–	no query	6.118
CONFigure:OLP:LIMit[:SCALar]:SYMMetric[:COMBined]:VALue	<Limit>	with query	6.119
CALCulate[:SCALar]:OLP:MATChing:LIMit?	<Result>	query only	6.119
FETCh:OLP:STATus?	OFF | RUN | STOP | ERR | STEP | RDY, 1 to 1000 | NONE	query only	6.119
READ[:SCALar]:OLP?	<Result>	query only	6.119
FETCh[:SCALar]:OLP?	<Result>	query only	6.119
SIGNalling – Connection Control			
PROCedure:SIGNalling:ACTion	SOFF | SON | CTMobile | UNRegister | CRELease	no query	6.116
[SENSe:]SIGNalling:CNUMber?	<max. 129 digits>	query only	6.118
[SENSe:]SIGNalling:DNUMber?	<max. 129 digits>	query only	6.118
[SENSe:]SIGNalling:IMEI?	<max. 18 digits>	query only	6.118
[SENSe:]SIGNalling:RIDentity?	<max. 18 digits>	query only	6.118
[SENSe:]SIGNalling:RIType?	UNKN | IMSI | IMEI | IMSISV | TMSI	query only	6.117
[SENSe:]SIGNalling:STATe?	SOFF | SON | REG | PAG | ALER | CEST	query only	6.117
Speech Codec			
ROUTe:SPDecoder:OUTPut	HANDset | ANALyzer | ANA2 | ABOTh	with query	6.145
ROUTe:SPENcoder[:INPut]	HANDset | GENerator	with query	6.145
TRIGger – Trigger Settings			
DEFault:TRIGger[:SEQuence]	ON | OFF	with query	6.147
TRIGger[:SEQuence]:DELay	0 to 14, –2559.75 to +2559.75	with query	6.146
TRIGger[:SEQuence]:SLOPe	POSitive | NEGative	with query	6.147
TRIGger[:SEQuence]:SOURce	FRUN | EXTern | INTern | IFPower	with query	6.146
TRIGger[:SEQuence]:THReshold:IFPower	<Threshold>	with query	6.147
UECapability – UE Radio Access Capabilities			
[SENSe:]UECapability:MMODe?	FDD | TDD | FTDD	query only	6.122
[SENSe:]UECapability:MRATe?	<GSM Support>, <Multi-carrier mode>	query only	6.123
[SENSe:]UECapability:MRELated?	<DL Compressed Mode>, <UL Compressed Mode>	query only	6.123
[SENSe:]UECapability:PDCP?	<SRNS relocation>,<RFC 2507>,<Header Compression>	query only	6.121
[SENSe:]UECapability:PDOwnlink?	<Simult. Tr. Channel>, <Simult. CCTr. Channel>, <TTITransportBlocks>, <Number of TFC>, <Number of TF>, <Turbo Decoding>, <Received Bits All>, <Received Bits Convolutionally Coded>, <Received Bits Turbo coded>, <PhyChannelFDD DPCH/PDSCH codes>, <PhyChannelFDD PhysicalChannelBits>, <PhyChannelFDD SF512>, <PhyChannelFDD PDSCH>, <PhyChannelFDD ChannelEstimation Pilots>, <Simult. Reception SCCPCH/DPCH>, <Simult. Reception SCCPCH/DPCH/PDSCH>, <Simult. Reception SCCPCH radio links>	query only	6.121

Command (Connection Control, Signalling)	**Parameter**	**Remark**	**Page**
[SENSe:]UECapability:PUPLink?	<Simult. Tr. Channel>, <Simult. CCTr. Channel>, <TTITransportBlocks>, <Number of TFC>, <Number of TF>, <Turbo Encoding>, <Transmitted Bits All>, <Transmitted Bits Convolutionally Coded>, <Transmitted Bits Turbo Coded>, <PhyChannelFDD DPDCH Bits per 10ms>, <Phys. Channel FDD PCPCH>, <Phys. Channel FDD UE Power Class>	query only	6.122
[SENSe:]UECapability:RFParameters?	<Tx/RX Freq. Separation>	query only	6.122
[SENSe:]UECapability:RLC?	<AM Buffer Size>,<Max. RLC Window Size>,<Max. AM Entities>	query only	6.121
[SENSe:]UECapability:UEPosition?	<Standalone Loc. Method>, <NetworkAssisted GPS>, <GPS Reference Time>, <IPDL>, <OTDOA UE Based Method>, <Rx/Tx Time Difference>	query only	6.123
UESignal – UE Signal			
DEFault:UESIGnal	ON | OFF	with query	6.126
CONFigure:UESignal:AMODe	WOOFfset | WIOFfset	with query	6.125
CONFigure:UESignal:CHANnel	1922.4 MHz to 1977.6 MHz | 1852.4 MHz to 1907.6 MHz | 1712.4 MHz to 1782.6 MHz	with query	6.124
UNIT:UESignal:CHANnel	HZ | KHZ | MHZ | GHZ | CH	with query	6.124
DEFault:UESIgnal:CSETtings	ON | OFF	with query	6.124
CONFigure:UESignal:DPCH:CMODe	0 | 1	with query	6.125
CONFigure:UESignal:DPCH:SNUMber	0 to 14	with query	6.125
CONFigure:UESignal:DPCH:SYMode	ASL | SYNC	with query	6.125
CONFigure:UESignal:DPDCh:AUTO:THReshold	–25 dB to +10 dB	with query	6.126
CONFigure:UESignal:FOFFset	–100 kHz to 100 kHz	with query	6.124
DEFault:UESignal:PCONtrol	ON | OFF	with query	6.126
CONFigure:UESignal:PCONtrol:OLPC:CVALue	–35 dB to –10 dB	with query	6.127
CONFigure:UESignal:PCONtrol:OLPC:DPCCh:POFFset	–164.0 dB to –6.0	with query	6.128
CONFigure:UESignal:PCONtrol:OLPC:INTerference	–110 dB to –70 dB	with query	6.127
CONFigure:UESignal:PCONtrol:OLPC:PCPich:RPOWer	–10 dBm to +50 dBm	with query	6.127
CONFigure:UESignal:PCONtrol:TPOWer:REFerence	TPOWer | DPCCh	with query	6.127
CONFigure:UESignal:PCONtrol:TPOWer:VALue	– 50 dBm to +33 dBm	with query	6.127
CONFigure:UESignal:PCONtrol:UEPower	– 50 dBm to +33 dBm	with query	6.126
CONFigure:UESignal:SCODe:SECondary	#H0 to #HFFFFFF	with query	6.125

Table 6-5 Remote-control commands, alphabetical list (Non Signalling)

Command (Non Signalling, alphabetical)	**Page**
ABORt:CDPower:AUTomatic	*6.99*
ABORt:CDPower:MANual	*6.103*
ABORt:CDPower:RAUTomatic	*6.99*
ABORt:CDPower:RMANual	*6.103*
ABORt:MODulation:EVMagnitude:QPSK	*6.56*
ABORt:MODulation:EVMagnitude:WCDMa:DPCH	*6.56*
ABORt:MODulation:MERRor:QPSK	*6.63*
ABORt:MODulation:MERRor:WCDMa:DPCH	*6.63*
ABORt:MODulation:OVERview:QPSK	*6.50*
ABORt:MODulation:OVERview:WCDMa:DPCH	*6.50*
ABORt:MODulation:PERRor:QPSK	*6.70*
ABORt:MODulation:PERRor:WCDMa:DPCH	*6.70*
ABORt:OLP	*6.118*
ABORt:POWer:ILTPc	*6.41*
ABORt:POWer:MAXimum	*6.32*
ABORt:POWer:MINimum	*6.32*
ABORt:POWer:OFF	*6.32*
ABORt:RXQuality:BER	*6.110*
ABORt:RXQuality:UEReport	*6.114*
ABORt:SPECtrum:EMASk	*6.92*
ABORt:SPECtrum:MFFT	*6.84*
ABORt:SPECtrum:MFILter	*6.77*
CALCulate:ARRay:CDPower:MANual:AVERage:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:MANual:CURRent:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:MANual:MAXimum:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:MANual:MINimum:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:RMANual:AVERage:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:RMANual:CURRent:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:RMANual:MAXimum:MATChing:LIMit?	*6.109*
CALCulate:ARRay:CDPower:RMANual:MINimum:MATChing:LIMit?	*6.109*
CALCulate:ARRay:POWer:ILTPc:STEP:CURRent:MATChing:LIMit?	*6.47*
CALCulate:ARRay:POWer:ILTPc:THReshold:CURRent:MATChing:LIMit?	*6.48*
CALCulate:ARRay:SPECtrum:EMASk:AVERage:MATChing:LIMit?	*6.98*
CALCulate:ARRay:SPECtrum:EMASk:CURRent:MATChing:LIMit?	*6.98*
CALCulate:ARRay:SPECtrum:EMASk:MAXimum:MATChing:LIMit?	*6.98*
CALCulate[:SCALar]:MODulation:EVMagnitude:QPSK:MATChing:LIMit?	*6.60*
CALCulate[:SCALar]:MODulation:EVMagnitude:WCDMa:DPCH:MATChing:LIMit?	*6.60*
CALCulate[:SCALar]:MODulation:MERRor:QPSK:MATChing:LIMit?	*6.67*
CALCulate[:SCALar]:MODulation:MERRor:WCDMa:DPCH:MATChing:LIMit?	*6.67*
CALCulate[:SCALar]:MODulation:OVERview:QPSK:MATChing:LIMit?	*6.55*
CALCulate[:SCALar]:MODulation:OVERview:WCDMa:DPCH:MATChing:LIMit?	*6.55*
CALCulate[:SCALar]:MODulation:PERRor:QPSK:MATChing:LIMit?	*6.74*
CALCulate[:SCALar]:MODulation:PERRor:WCDMa:DPCH:MATChing:LIMit?	*6.74*
CALCulate[:SCALar]:OLP:MATChing:LIMit?	*6.119*
CALCulate[:SCALar]:POWer:ILTPc:CURRent:MATChing:LIMit?	*6.46*
CALCulate[:SCALar]:POWer:MAXimum:MATChing:LIMit?	*6.40*
CALCulate[:SCALar]:POWer:MINimum:MATChing:LIMit?	*6.40*
CALCulate[:SCALar]:POWer:OFF:MATChing:LIMit?	*6.40*
CALCulate[:SCALar]:RXQuality:BER:MATChing:LIMit?	*6.113*
CALCulate[:SCALar]:SPECtrum:MFFT:MATChing:LIMit?	*6.89*
CALCulate[:SCALar]:SPECtrum:MFILter:MATChing:LIMit?	*6.83*
CONFigure:BSSignal:CHANnel	*6.129*
CONFigure:BSSignal:DCH:RMC: SDTCh	*6.133*
CONFigure:BSSignal:DCH:RMC:DLRessource	*6.132*
CONFigure:BSSignal:DCH:RMC:RTYPe	*6.132*
CONFigure:BSSignal:DCH:RMC:TMODe	*6.133*
CONFigure:BSSignal:DCH:RMC:UCRC	*6.132*
CONFigure:BSSignal:DCH:SRAB:SRB	*6.134*
CONFigure:BSSignal:DCH:TYPE	*6.132*
CONFigure:BSSignal:DCH:VOICe:ACSet	*6.134*
CONFigure:BSSignal:DCH:VOICe:SOURce	*6.133*

Command (Non Signalling, alphabetical)	***Page***
CONFigure:BSSignal:FOFFset	*6.129*
CONFigure:BSSignal:LREFerence	*6.130*
CONFigure:BSSignal:OCNS	*6.130*
CONFigure:BSSignal:OPOWer	*6.130*
CONFigure:BSSignal:PHYSical:CODE:DPDCh	*6.137*
CONFigure:BSSignal:PHYSical:DPCH:POFFset	*6.137*
CONFigure:BSSignal:PHYSical:LEVel:AICH	*6.136*
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:PRIMary	*6.135*
CONFigure:BSSignal:PHYSical:LEVel:CCPCh:SECondary	*6.136*
CONFigure:BSSignal:PHYSical:LEVel:CPICh:PRIMary	*6.135*
CONFigure:BSSignal:PHYSical:LEVel:DPDCh	*6.136*
CONFigure:BSSignal:PHYSical:LEVel:PICH	*6.136*
CONFigure:BSSignal:PHYSical:LEVel:SCH:PRIMary	*6.135*
CONFigure:BSSignal:PHYSical:LEVel:SCH:SECondary	*6.135*
CONFigure:BSSignal:SCODe:PRIMary	*6.129*
CONFigure:BSSignal:SCODe:SECondary	*6.137*
CONFigure:BSSignal:TPC:MODE	*6.138*
CONFigure:BSSignal:TPC:PATTern<nr>	*6.139*
CONFigure:BSSignal:TPC:PSET	*6.138*
CONFigure:BSSignal:TPC:PTYPe<nr>	*6.139*
CONFigure:BSSignal:TPC:RPATtern	*6.139*
CONFigure:BSSignal:TPC:SSIZE	*6.138*
CONFigure:CDPower:AUTomatic:CONTrol:DSFactor	*6.101*
CONFigure:CDPower:AUTomatic:CONTrol:REPetition	*6.101*
CONFigure:CDPower:AUTomatic:CONTrol:RMODe	*6.100*
CONFigure:CDPower:AUTomatic:EREPorting	*6.100*
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>	*6.107*
CONFigure:CDPower:MANual:AVERage:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>	*6.107*
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:LOWer:CHANnel<nr>	*6.106*
CONFigure:CDPower:MANual:CMMax:LIMit:POINt:ASYMmetric:UPPer:CHANnel<nr>	*6.106*
CONFigure:CDPower:MANual:CONTrol:REPetition	*6.105*
CONFigure:CDPower:MANual:CONTrol:RMODe	*6.104*
CONFigure:CDPower:MANual:CONTrol:STATistics	*6.104*
CONFigure:CDPower:MANual:EREPorting	*6.103*
CONFigure:CDPower:RAUTomatic:CONTrol:DSFactor	*6.101*
CONFigure:CDPower:RAUTomatic:CONTrol:REPetition	*6.101*
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9 Error Messages

In case of an error during operation, the CMU displays a yellow notice box with a message describing the error and one or several buttons to close the box and continue operation. Many error messages are defined in the SCPI standard and not related to a particular function group. These SCPI error messages are listed in chapter 9 of the CMU operating manual. The notice boxes listed below are specific to the *WCDMA UE TX Test (3GPP/FDD)* function group.

Table 9-1: WCDMA-specific error messages

Message	**Explanation**
Reference frequency not locked	The synchronization to an external reference signal fed in via REF IN failed; see *Reference Frequency* softkey in the *Synch.* tab of the *Connection Control* menu.
Scrambling code or slot format does not match input signal	The CMU is unable to correctly detect the beginning of a slot because the analyzed signal does not conform to the *Scrambling Code* or the *Slot Format* set in the *UE Code* tab of the *Connection Control* menu. The error may occur in all measurements with channel decoding, e.g. in the *Modulation...WCDMA* applications or in a *Code Domain Power* measurement. If the error occurs, the measurement results are very likely to be wrong.

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